

# Infection Prevention Strategies in the NICU: Current Concepts

PMC Nair<sup>a</sup>

a. Department of Paediatrics & Neonatology, Sree Gokulam Medical College, Trivandrum & Fellow Neonatal Intensive Care (Australia)\*

Published on 24<sup>th</sup> June 2019

## Interviewer

Infection is a leading cause of morbidity and mortality in newborns. I would like to discuss about the infection prevention strategies in the NICU, and its current concepts.

### Q. What is the present global scenario of sepsis in newborn?

A. Incidence of sepsis in newborns is around 6-8% in the West, while in India it is more than 38% with mortality ranging up to 30%. Since the symptoms, signs and laboratory investigations are most often non-specific, either the diagnosis is missed with direct consequences or the baby is over-treated unnecessarily with antibiotics. Hence infection prevention strategies are of paramount importance in the Neonatal Intensive Care. Many decisions taken in the NICU management are shrouded in controversies and hence clear-cut guidelines are the need of the hour.

### Q. What is the role of hand hygiene and hand washing?

A. The chief culprit most of the time is hand hygiene. Hand & glove contamination often are responsible for spreading multi-drug resistant organisms. Knowledge is not always translated into practice. Hand hygiene education temporarily improves hand-washing rates, but over time, compliance tends to deteriorate. Observational studies have shown that clinicians wash hands only 40% of the time that they should. Ignaz Semmelweis in 1847 showed the importance of hand “degerming” in the prevention of puerperal sepsis. But it took a very long time later on for Centers of

Disease Control (CDC) to declare that “hand washing is the single most effective method to prevent spread of nosocomial infection”.

### Q. What is the choice of best method of hand hygiene?

A. Washing with soap (ordinary/antiseptic) or povidone-iodine or hand rub with alcohol or alcohol and chlorhexidine based gel are the accepted methods. Girou et al showed a reduction in sepsis of 83% with alcohol based preparation compared to 58% reduction with antiseptic soap. Comparing hand hygiene measures in a Neonatal ICU, Sharma et al concluded that initial hand-washing for 2 minutes & then in between babies alcohol hand rub is superior to povidone-iodine. Plain soap is inferior to both. Alcohol hand rub showed greater reduction in bacterial counts and better acceptance by the staff.

CDC guideline recommends the use of alcohol based hand rubs. If hands are visibly soiled or contaminated, hand washing should be done for 2 minutes with soap & water. If hands are not visibly soiled before touching a baby, hand decontamination should be done with alcohol-based hand rub.

Hand-rub solutions contain chlorhexidine gluconate (0.5%) and 70% ethanol. Alcohol denatures microbial proteins with rapid onset of action but has no residual activity, and chlorhexidine gluconate cause attachment & disruption of bacterial cytoplasmic membrane and has persistent activity up to 6 hours. Efficacy depends on the concentration (50-80%), contact time & volume. It has good activity against Gram positive & negative bacteria, mycobacteria, fungi and viruses.

Cite this article as: Nair PMC. Infection Prevention Strategies in the NICU: Current Concepts. IMA Kerala Medical Journal. 2019 Jun 24;12(2):50–3.

## Corresponding Author:

Dr PMC Nair, Professor & HOD, Department of Paediatrics & Neonatology, Sree Gokulam Medical College, Trivandrum & Fellow Neonatal Intensive Care (Australia)

### **Q. Consensus regarding hand washing while entering NICU**

A. The consensus includes; remove all wrist & hand jewellery, roll up sleeves up to above elbow, stand slightly away from the sink to avoid being splashed, elbow/ foot/ knee/ sensor operated taps are ideal to prevent touching the tap and contaminating the sterile hand.

- Wash with soap & water or micro-shield hand scrub for 2 minutes in the sequence of; Palms and fingers (web spaces), back of hands, fingers and knuckles, thumbs, finger tips, wrists and forearm up to the elbow.
- Keep elbows always dependent. Close the tap using the elbow.
- Do not keep long or polished nails.

### **Alcohol based hand rub for 30 seconds or hand wash for 30 sec**

- Before touching a baby or in between babies
- Before changing probes/ linen / blood pressure measurement, after touching equipments, attending phone calls, etc.

### **Wash hands before & after**

- Touching an infected baby.
- For-skin breach procedures- like canulation/ sampling etc.

### **Dry hands using sterile paper napkins**

- Avoid common towel or hand dryer. Hand dryer filters if not properly maintained can contaminate wet hands with boluses of microbes and hence not recommended.

### **Gowns, masks, caps**

- Systematic review of 8 studies showed no evidence in favour of gowns, caps and masks in reducing mortality, clinical infection or bacterial colonization in NICU. Currently there's no evidence to support use of wearing gown/ mask/ cap in NICU as a routine. However in Indian setting, there is risk of transporting infection laden dust & fomites to NICU and hence it is suggested that you wear gown while entering the unit or change to NICU uniform to minimize exposure of Newborn to extraneous infection.

### **Sterile Gown & Mask**

- Mandatory before invasive procedures like

lumbar puncture, exchange transfusion, putting central lines etc. You should wear mask if you are suffering from common cold. Mask should cover both the mouth and nose snugly and should never be lowered around neck and reused.

### **Sterile gloves**

- It is mandatory to wear gloves for all invasive procedures, change of IV fluids/ canulation/ intubation and handling infected patients.

### **Slippers**

- Change over to clean nursery slippers or closed-toe shoes on entry into the NICU. Slippers should be cleaned once in every week.

### **Q. How to prevent spread of microbes between babies**

A. The NICU should be located in a less traffic exposed area of the hospital and should be spacious and well ventilated. There should be no overcrowding of babies and should have adequate staff pattern.

### **Adequate nursing staffs: CDC consensus**

- Critical care, multisystem support -1: 1
- Newborn requiring intermediate care-1: 2-3
- Newborn requiring continuing care- 1: 3-4
- Newborn requiring only routine care -1: 6-8

Stethoscopes, stock solutions and telephone may become fomites (infected objects) and hence each baby should have a separate stethoscope. After touching the telephone the staff should use the alcohol based hand rub before touching a baby.

### **Q. Should we vigorously clean & remove vernix? Should we give bath to baby immediately in the hospital?**

#### **Consensus**

- Clean all infants at birth with a clean, sterile cloth to remove blood clots and/or meconium present on the body. Vernix is protective for the baby and one should not attempt to remove vernix from the body by any means (can result in trauma to skin & increase chance of infections). Baby can be given bath after 12-24 hrs. Avoid routine bathing in hospital because of the risks of cross infection & hypothermia. Infant can be sponged, as required. Give bath at home once discharged. In preterm babies delay bath till they attain a weight of at-least 2kg.

**Q. Umbilical cord care, skin and eye care?**

A.

**Umbilical cord care**

- Umbilical cord must be kept open & dry, may be cleaned with sterile saline. The nappy should be folded well below the umbilical stump. If the cord is unhealthy –clean the cord with spirit/ chlorhexidine and apply Mupirocin ointment.

**Skin Care**

- The skin barrier is compromised in the neonate particularly in the preterm infant, because of the thinner stratum corneum and is easily damaged by handling, adhesives, alcohol and povidon-iodine applications. Once baby is stable, oil massage may be given. It provides thermal insulation, keeps skin supple, prevents skin cracks, and provides kinesthetic stimulation and probably decreases nosocomial infection.

**Decolonisation of bacteria**

- Methicillin resistant staph aureus ( MRSA) is a significant problem in some NICUs. Nares & umbilicus are the most frequent sites of colonization, the risk factors being extreme prematurity and low birth weight. Decolonization of bacteria in such situations by daily Mupirocin to nostrils, umbilicus and any abrasions or cuts and daily chlorhexidine bath have been tried. Can decolonization of MRSA-colonized neonates reduce the incidence of subsequent MRSA infection and also the risk of developing resistance remains questionable.

**Eye care**

- Silver nitrate eye drops or Penicillin eye drops to prevent Ophthalmia neonatorum had been a routine earlier but the current consensus is to clean the eyes with sterile swab soaked in normal saline or sterile water. Clean from inner to outer canthus .Use a separate swab for each eye. There is insufficient evidence to recommend routine antibiotic prophylaxis in Indian settings for prevention of ophthalmia neonatorum

**Q. Should we restrict people entering the NICU: Restrict visitors to prevent cross infection**

A. But we should allow unlimited entry for father & mother. With parental participation and care by mother in the form of kangaroo mother care, providing non-nutritive sucking or direct breast feeding, chance of infection and duration of hospital stay are all decreased.

Employee with Fever, Gastroenteritis, Respiratory infections, wet lesions like Staphylococcal or Herpetic lesions should keep away from the nursery and instead do some desk job.

**Q. Role of medication preparation**

A. Prepare the intravenous fluids under aseptic conditions and fluids mixing should be under laminar flow. Never use stock solution (like heparinised saline) for flushing. Never use multiple dose vials. Needles should not be left vented on to bottle stopper. Use disposables each time.

**Q. Environmental hygiene**

A. Avoid dry dusting and sweeping because of the risk of dissemination of bacteria. Vacuum cleaning or wet mopping is preferable. Regular and thorough cleaning will decrease the microorganisms on surfaces and help prevent infection. Every NICU should have a house keeping schedule and sufficient number of cleaners and attenders must be posted in this area as it is a high risk zone. Once a week, in addition to routine mopping of floors and walls with disinfectant, thorough washing and cleaning of the unit is most effective. There is no short cut to asepsis. Swinging doors in the NICU can create turbulence and add to microbial burden; sliding doors are preferred. Air conditioner filters may harbor Aspergillus / acinetobacter/ pseudomonas. Preventive filter & duct maintenance and cleaning are important. Frequent shutdown and restart of AC can release organisms settled inside the duct into the NICU. It is recommended that the air conditioner should provide at least 12 air changes in NICU per hour. The air conditioning ducts should have 0.5 micron bacterial filters which should be cleaned periodically. Also incubator and laminar flow filters should be cleaned periodically. Equipment asepsis is very essential, and every unit should have an equipment disinfection/sterilization protocol which should be strictly adhered to.

**Q. How to prevent Central line associated blood stream infection (CLABSI)**

A. Extended use, excessive manipulation, urgent insertion, frequent access & a high-risk host are some of the important risk factors for CLABSI. Hand hygiene is a key factor. Rates of CLABSI are significantly lower in hospitals with high rates of hand hygiene compliance. Catheter hub is the most likely portal of entry of microorganisms for central line catheter contamination. A biofilm develops at the site in 24 hours of placement. When bacteria are introduced through the hub, the biofilm is an ideal site for bacteria to embed, grow,

and hide from the patient's immune system and from antibiotics.

Best practices to prevent CLABSI includes; hand hygiene, skin antiseptics with chlorhexidine (chlorhexidine gluconate in an alcohol base is a better alternative to povidone-iodine), maximal barrier precautions during insertion and care of central lines (use standard IV insertion packs), optimal catheter hub care (recently 0.5% chlorhexidine gluconate in 70% alcohol has been shown to be more effective than alcohol alone in decontaminating the entry ports), central line team (routine insertion and care by a central line team significantly reduces blood stream infection rate) and limiting the duration of IV lines (once baby is hemodynamically stable, start minimal enteral feeds).

#### **Q. The role of “Antibiotic lock”**

A. Vancomycin-heparin lock solution for prevention of nosocomial bloodstream infection in critically ill neonates with peripherally inserted central venous catheters, 2-3 times daily. Cochrane systematic review in 2000 showed reduction in late onset sepsis with prophylactic low dose Vancomycin in extreme low birth weight babies but is not recommended as a general policy.

#### **Q. Drugs associated with Hospital acquired infections (HAI)**

A. Limiting the use of drugs associated with HAI; avoid H2 antagonists (like Ranitidine) & proton pump inhibitors especially in VLBW & ELBW (altering gastric pH increase predisposition to infection especially

NEC), Postnatal steroids should be avoided. Steroids cause immune-suppression and should be restricted to definite indication only and for the shortest possible time.

#### **Q. What is meant by Antimicrobial “stewardship”?**

A. To reduce antibiotic resistance use the antibiotics judiciously, 3rd generation Cephalosporins like cefotaxime and carbapenems like meropenem should not be used as first line. They lead to the development of extended spectrum beta-lactamases (ESBL) and fungal sepsis. Reserve the use of cefotaxime for meningitis, because of its better CSF penetration. Use the narrowest spectrum of antibiotics. Every unit should have a written antibiotic policy which should be strictly adhered to. Rotate antibiotics every 3-6 months to prevent development of resistance.

#### **Q. Role of breast milk in prevention of neonatal sepsis**

A. Only breast milk has shown unequivocal evidence in reducing sepsis and NEC. The various bioactive factors in breast milk such as Lactoferrin, Lactoperoxidase, Lysozyme, Secretory IgA, Cytokines (IL-10), Enzymes (PAF-acetyl-hydrolase), Growth factors (Epidermal growth factor- EGF), Nucleotides, Oligosaccharides, Antioxidants, Glutamine, Polyunsaturated fatty acids, all these modulate inflammatory cascade and alter mucosal environment. Human milk oligosaccharides, present in highest concentration in colostrums, promotes growth of *Bifidobacterium bifidum*, prevent binding of bacteria to intestinal cells and protects from infection.