Evidence-Based Skin Care for Newborns

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Objectives
- Discuss pertinent elements of national guidelines related to NB skin care
- Identify areas in your setting that might be enhanced by use of guidelines
- Format:
  - basics of skin structure and function
  - factors that influence skin integrity
  - 2013 guidelines on neonatal skin care

The skin is largest organ in the body
- Preterm skin makes up 13% of weight, versus 3% of adult
- Skin integrity essential to survival
  - any break is portal of entry

Basic Components of the Skin
- Epidermis: barrier against toxins and bacteria, retains both heat and water
  - exfoliating dead cells
- Dermis: collagen and elastin fibers that provide strength and elasticity
  - blood vessels and nerves
  - 60% as thick as an adults
- Subcutaneous tissue: insulation, shock absorption and calorie storage area
  - fatty connective tissue

Factors that Influence Skin Integrity
Skin pH
- pH <5 offers bacteriocidal quality
- acid mantle = barrier to microorganisms
- term skin pH >6 at birth, <5 by 4 days
- preterm “mantle”, pH<5
  - not until ~ month
- with alkaline soap need
  - > hour to drop pH <5
Factors that Influence Skin Integrity

- **Skin Maturation**
  - Fetal skin development follows a clear pattern.
  - At term, barrier function is similar to that of adults.
  - Premature infants undergo a change from aquatic to aerobic conditions, accelerating maturation.
  - Delayed in lower GA.

- **Stratum corneum**
  - Less keratinized and thinner as GA decreases.
  - Term: 10-20 layers.
  - Preterm: 2-3 layers.

- **Epidermis**
  - Premature infants over 26 weeks show improved barrier function within several weeks.
  - Delayed to 30-32 weeks if < 26 weeks.

- **Preterm skin permeable to toxins & TEWL**
  - Barrier function limited for the first year.

Factors that Influence Skin Integrity

- **Preterm Cohesion**
  - Epidermis & dermis linked by thin fibrils.
  - Stronger and more numerous with age.
  - Diminished cohesion between layers, at risk for epidermal stripping.
  - Bond between skin and adhesives may be stronger than bond between skin layers.

AWHONN 2013 Guidelines

- Vernix
- Bathing
- Cord care
- Circumcision care
- Diaper dermatitis
- Disinfectants

- Adhesives
- Skin breakdown
- IV infiltrates
- Emollients
- TEWL
- Nutrition

Vernix: Nature’s Waterproofing

- Decreases skin permeability and TEWL.
- Cleanses and moisturizes skin.
- Protects against infection.
- Reduces pH and creates “acid mantle”, inhibits growth of pathogenic bacteria.
- Temperature regulation.

Bathing: General Considerations

- Staff and family: hand washing with antibacterial cleanser prior to bathing.
- Community acquired infections.
- Tub disinfection.
First Bath
- Once thermal and CR stability achieved
- Goal: Remove unwanted soils (meconium, blood) and leave residual vernix intact
  - Universal precautions
  - Minimal amount of pH -neutral or slightly acidic cleanser to assist with removal of blood and amniotic fluid

Product Selection
- No specific products
- Minimal product use
- Potential toxicity, especially if preterm
- Avoid unnecessary exposure to chemicals

Skin Cleansers
- Cleansers with least irritating ingredients
  - Neutral or mildly acidic pH (5.5-7.0)
  - Preservatives with demonstrated safety in newborns
  - No antimicrobial soaps
  - Avoid soap-based products

Routine Bathing: Term Newborns
- Bathing is not an innocuous procedure
- Daily bath not clearly justified for NB
- May bathe every few days "to remove debris and for general hygiene"
- Shampoo X1-2/week
- Immersion preferred over sponge bathing

Immersion Bathing
- Stable infants safely immersed
- No increase in rate of bacterial colonization or infection of cord
- Immerse entire body (except head and face) with warm water (100.4°F or 38 °C)

Immersion Bathing
- After bath, dry/diaper baby
- Double wrap in blankets with cap for head
- Ten minutes later...dress the baby, change the cap and wrap in dry warm blankets
  - large drops in temp noted 10 min post bath, due to dampening of clothing
Routine Bathing: Preterm < 32 Weeks
- Vulnerable to disruption and toxicity from topically applied substances
  - Water baths only during first week
  - Warm sterile water if breakdown
- Soft cloth, avoid rubbing
- Sponge baths stressful
- Swaddled or immersion bathing preferable

Routine Bathing: Preterm Infants
- Should not be bathed daily
- “The bathing schedule for preterm infants should be based upon the infant’s physiologic condition and behavioral state”

Cord Care
- Cord potential port of entry for invasive bacterial pathogens
- Good hand hygiene to avoid community-acquired infections such as MRSA
- Dry cord care leads to shorter separation times
- Topical drying agents: no benefits on separation, colonization, or infection

Cleanse cord during first bath with water or cleanser of choice
- Dry thoroughly with clean gauze
- If soiled, clean with water and dry
- Keep cord clean/dry outside diaper

Diaper Wipes
- Some contained preservatives, alcohol, and perfumes that could irritate skin
- Newer formulations with fewer additives reported to be well tolerated and mild
- Soft cloth with water, or mild cleanser and water are also acceptable options

Educate Parents about Cord Care
- Hand hygiene
- Keep clean and dry
- Moist, mucky appearance is normal
- Redness, swelling and drainage abnormal
- Allow cord to fall off
Diaper Dermatitis

- Acute inflammatory reaction of the skin
- First signs are erythema and mild scaling
- If not treated promptly, can progress to painful excoriated or ulcerated lesions
- Preferable/easier to prevent than treat
  - Frequent stools, opiate withdrawal, antibiotics, malabsorption, etc

Diaper Dermatitis

- CHOP: Systematic assessment tool with suggested treatment recommendations using six categories
  - Petrolatum
  - Zinc oxide barrier cream
  - Pectin-based paste and/or powder
  - Antifungal topical agents (candida)
  - Plastic polymer film for kids > 28 days

Candida

- Symmetric distribution, satellite lesions
- May be erythematous, swollen or scaly
- Worsen if occlusive ointments other than antifungal ointments used

Disinfectant Dilemma

Evidence is insufficient to recommend a single product for all newborns.

- Efficacy
- Potential for toxicity
- Skin irritation or breakdown
Disinfectants: The Competitors

- Isopropyl alcohol
- 10% Povidone-iodine (PI)
- Chlorhexidine gluconate (CHG)

Isopropyl alcohol

- Drying to skin and is least effective
- Avoid use as primary disinfectant
- Don’t use to remove either CHG or PI
- Chemical burns in preterms
- Use to disinfect needleless connectors and other access ports, preventing BSI

Povidone iodine (PI)

- 10% aqueous solution
- Single use products
- Better than alcohol for skin disinfection
- Apply and allow to dry for 30 sec
- Remove completely after use
- Risk of absorption: Elevated iodine levels and thyroid suppression

2% Chlorhexidine Gluconate (CHG)

- Used in aqueous solutions and in combination with isopropyl alcohol
- Bactericidal properties, effective against gram positive and negative organisms
- Also binds to protein in stratum corneum, leaving residual bactericidal effect that is resistant to alcohol removal

Meta-analysis of eight studies (n=4143 catheters) in adults determined CHG disinfection reduced BSI risk by 49%

But, current CDC guidelines indicate that there is insufficient evidence to make a recommendation about safety or efficacy of CHG products in infants less than two months of age

2% Chlorhexidine gluconate (CHG)

- Per 2012 FDA regulations, some CHG/alcohol-containing products are now labeled: “Use with care in preterm infants or in infants less than 2 months of age. These products may cause irritation or chemical burns”
- NICU’s may use the product “off label” as indicated for disinfection
2% Chlorhexidine gluconate (CHG)
- Systemic toxicity not yet seen in NB's
- Local reactions to impregnated dressings
- Chemical burns in VLBW
- European use for ~ 30 years, increasingly in US & Canada in recent years

Chlorhexidine Gluconate Options
2% Aqueous CHG, poured onto applicators or 2X2's
Chloraprep: 2% CHG in 70% isopropyl alcohol

Disinfectant Options: "Insufficient evidence to recommend a single product"
- 2% Aqueous CHG
- Chloraprep for larger infants, PI or 2% Aqueous CHG for infants < 1500 grams
- 10% PI for all NB's, all procedures

Disinfectant Dilemma
- All have potential to damage skin and interfere with tissue function
  - Disinfectants kill bacteria
  - Damage or destroy fibroblasts and keratinocytes in healing wounds
- Limit time and area of exposure
- Remove with sterile water or saline

Adhesives
- Primary cause of skin breakdown
- Strips epidermis, disrupts barrier
- Use sparingly
- Double back tape
- Avoid bonding agents, solvents, bandages after drawing labs

Adhesive Damage is Painful
- Remove using water-soaked cotton balls, pull tape at low level, parallel to skin
  - petrolatum if re-taping not anticipated
- Anetoderma: Atrophic patches of skin due to dermal thinning
Adhesive Options
- Hydrogel electrodes
- Semipermeable dressings
  - Allow skin to “breathe”
  - IV’s, PICC’s, NG/OG’s and nasal cannulas
- Stretchy gauze to secure electrodes, probes and limbs to armboards
- “Tender grips” adhesive circles for NC

Pectin or Hydrocolloid Barriers
- Shown to cause skin trauma equal to tape when removed at 24 hours
- Absorbs moisture, molds well to skin surface, and prevents application of tape directly to face
- Useful with ETT, NC for extended periods

Silicone Based Adhesive Products
- Shown to improve adherence to wounds, reduce discomfort during tape removal
- Holds promise for new products that adhere, with minimal trauma upon removal
- Mepitac: soft silicone layer that provides secure fixation but no epidermal stripping
- Secure non-life sustaining devices

Minimize Risk of Breakdown
- Reposition medical devices
- Water/air/gel mattress
- Sheepskin/soft surfaces
- Transparent dressings over bony prominences
- Petrolatum-based ointments to groin/thigh of VLBW infants

Skin Breakdown
- Culture and treat if signs of bacterial or fungal infection
- Cleanse affected area
  - Sterile water/saline
  - No disinfectants
  - Debride, don’t scrub
- Moistening tissue facilitates healing

“Moist Healing” Environments
- Dressing: Occlusive, nonadherent, and provides moist healing that promotes rapid migration of epithelial cells and protects wound from further injury
- Use hydrogel, transparent dressings and hydrocolloids and leave in place for extended periods (remoisten hydrogels)
- Serous exudate often forms (leukocytes)
Wound care options

- Transparent dressings (Tegaderm)
  - uninfected wounds

- Hydrocolloid (Duoderm)
  - deep and/or uninfected wounds
  - absorbs exudate and acts as barrier

Emollients

- Products should be petrolatum-based, water miscible, no preservatives, perfumes and dyes
  - Unit dose or single patient use
  - May be used with photoRX/warmers

Petrolatum-based ointments

- For uninfected or infected lesions (after cleansing and application of antibacterials)
- Improves healing, reduces skin growth of gram neg organisms, and decreases severity of dermatitis
- Cautious use < 750 gms
- Not for fungal lesions

Emollients

- Protect integrity of stratum corneum and enhance barrier function
- Restore skin integrity
  - Gentle application at first sign of dryness, fissures or flaking
  - Watch for signs of systemic infections, especially < 750 gms

Wound care options

- Hydrogel (Vigilon, Flexigel or Transgel)
  - infected wounds in conjunction with antifungals or antibacterials
  - Mepitel, Mepilex soft silicone dressing

Dry Healing

- Scabs form a barrier to migration and spreading of epithelial cells and limits the rate at which healing occurs.

Moist Healing

- Scabs form a protective dry crust over the wound.
- Epithelial cells may migrate and spread more freely, promoting rapid healing.
- Greater access for inflammatory cells.
- Dressing provides a barrier to contamination, controlling temperature & moisture levels to promote healing.
Routine Emollient Use in VLBW

- Early emollient studies showed no increase in colonization patterns (Lane & Drost, 1993, Nopper et al, 1996, Pabst et al, 1999)
- RCT: Association between emollients used twice daily X2 wks and coagulase-negative S. epi in subset of infants < 750 grams. No difference in gram-negative bacterial or fungal infections Edwards et al, 2004
- Emollients used to treat dry skin during RCT did not increase infection rates

Benefits of emollient use for prevention of dermatitis and skin breakdown should be weighed against risk of infection

Transepidermal Water Loss

- Increased TEW and evaporative heat loss in infants <30 wks
  - At 23-25 wks have TEWL X10 > term
- Use a single method or combination of techniques to limit TEWL and heat loss
  - Need more fluids if TEWL not limited

Strategies to Reduce TEWL

- Polyethylene wrap at birth
- Supplemental conductive heat
- Semipermeable transparent dressings
- Polyethylene coverings or blankets

Humidity: Reducing TEWL

- TEWL depends on ambient water vapor pressure
- Raising ambient humidity increases water vapor pressure, and decreases fluid and heat loss via evaporation
- Humidity 70 - 90% for first 7 days
- After first week, gradually reduce to 50% until baby is 28 days old

Strategies to Reduce TEWL

- Humidity
  - Newer isolette designs include servo-controlled humidification using sterile water sources, eliminates reservoir as source of contamination
  - Actively generated humidification systems don’t cause air-borne aerosols that could be contaminated with microorganisms