An Overview of the 2013 Neonatal Skin Care Guideline

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Disclosures

• Investigator-initiated grant to study the first bath in full term newborns, 2012-13 (Johnson & Johnson Consumer Products)
• Member of professional advisory panels for Johnson & Johnson Consumer Companies, Inc. and 3M.
• Sponsored by 3M to provide professional education to nurses.
In 2001, an evidence-based Neonatal Skin Care Clinical Practice Guideline, written by a science team including neonatal nurses and a pediatric dermatologist, was evaluated in 51 nurseries, involving 2820 neonates. Skin scores improved after the guideline was implemented.

The guideline was revised in 2007 and included in the National Guideline Clearinghouse.

The 2013 guideline revision won 3rd place in the AJN Book of the Year Awards in maternal-child nursing.

Newborn Skin Assessment
Bathing
Vernix
Umbilical Cord Care
Circumcision Care
Disinfectants
Diaper Dermatitis
Medical Adhesives
Emollients
Transepidermal Water Loss in ELBW Infants
Skin Breakdown
Intravenous Infiltration

Association of Women’s Health Obstetric and Neonatal Nurses, 3rd edition (June 2013)
## Anatomic Differences in Neonatal Skin: Stratum Corneum

<table>
<thead>
<tr>
<th>Category</th>
<th>Layers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult SC</td>
<td>10-20</td>
</tr>
<tr>
<td>Newborn SC</td>
<td>10-20</td>
</tr>
<tr>
<td>Premature Infant</td>
<td>2-3</td>
</tr>
</tbody>
</table>

- 10-20 layers of stratum corneum in term infants and adults
- Far fewer layers in premature infants <30 weeks, increased fluid and heat losses
- Evaporimeter measures skin barrier function—TEWL (transepidermal water loss)
- 5-10 gms H$_2$O/m$^2$/hr in adults

*(Neonatal Skin: Structure and Function, 1982)*
Premature Infants and TEWL

- 23 weeks
  - 75 gmH²O/m²/hr
- 26 weeks
  - 45 gmH²O/m²/hr
- 29 weeks
  - 17 gmH²O/m²/hr
- 32-40 weeks:
  - 5-10 gmH²O/m²/hr
- Stratum corneum becomes mature at 30-32 weeks PCA
Strategies to Decrease TEWL and Evaporative Heat Loss

- Plastic wrap or bags
- Supplemental conductive heat (heated mattress)
- Incubator rather than radiant heater
- Humidity >70%
- Transparent adhesive dressings
- Emollients
Hats and Wraps and Bags
Increasing Humidity Reduces TEWL

Hammarlund K & Sedin G (1979) 
Acta Paediatr Scan 68:795-801
High Humidity for ELBW Infants
Improved Care and Growth Outcomes by Using Hybrid Humidified Incubators in ELBW Infants

- 70-80% RH for week 1, 50-60% RH week 2 until 30-32 weeks
- ELBW infants using hybrid incubator w/humidity
  - ↓ fluid intake, urine output, weight loss, hypernatremia
  - Improved growth rate
  - ↓ incidence severe BPD, duration of assisted ventilation
- Trend toward more sepsis, not statistically significant

Skin Assessment: Which Scale?

- **Braden Q**
  - Assess risk for ischemic pressure sores, skin breakdown in pediatric patients
  - Number of neonates studied not indicated, no premature infants included
  - **Does not predict device-related pressure sores**

- **Neonatal Skin Condition Score (NSCS)**
  - Evaluates overall skin condition, not a risk assessment
  - Used in original Neonatal Skin Project
    - Sample 2,820 neonates including ELBW infants
  - Validity, reliability demonstrated (Lund & Osborne 2004)
Device-related Pressure Ulcers
Neonatal Skin Condition Scale

• **Dryness:**
  – 1 = Normal, no signs dryness
  – 2 = Dry skin, visible scaling
  – 3 = Very dry skin, cracking/fissures

• **Erythema:**
  – 1 = No evidence erythema
  – 2 = Visible erythema, <50% body surface
  – 3 = Visible erythema, >50% body surface

• **Breakdown:**
  – 1 = None evident
  – 2 = Small, localized areas
  – 3 = Extensive

  – **Perfect score = 3**
  – **Worst score = 9**
First Bath

- Studies indicate that newborns bathed as soon as 1 hour after delivery will maintain their temperature if they have a normal temperature to begin with.

- AWHONN Guideline:
  - Vital signs, temperature stable 2-4 hours
  - Antiseptic cleaners not currently required by American Academy of Pediatrics, Center for Disease Control
  - Universal precautions until bathed
  - Not necessary to remove all vernix

- WHO: wait at least 6 hours

- Would they, or their mothers, choose to be bathed as early possible?
How to Give the First Bath?

- Sponge bath
- Under the faucet
- Small tub
- Large tub “immersion bath”
- Swaddle bath
Tub Bathing vs. Sponge Bathing

- **Hennigson (1981):** 232 newborns, no infection or colonization problems, better temperature, less crying with tub bathing
- **Hylen (1983):** 618 newborns, rectal temperatures better with tub bathing, no difference in infection
- **Anderson (1995):** axillary temperatures stable with tub bath, better for attachment and bonding
- **Cole (1999):** tub bath maintained temperature better, 70% remained drowsy or quiet alert vs 90% crying with sponge bath
- **Bryanton (2004):** 102 newborns randomized to tub or sponge bath. Tub bath less temperature loss, no differences in umbilical cord healing, behavior more content, mothers rated more pleasurable
- **Loring (2012):** 100 infants (35-36 6/7 weeks) randomized to immersion tub bathing or sponge bathing, tub bathed infants had overall higher and less variability in body temperature
Water alone vs. Baby Wash Studies

- **Gfatter (1997):** RCT 40 infants; all bathing (water, liquid cleanser, bar cleanser, soap) caused transient ↑ pH, ↓ SCH; significant only with soap
- **Hoeger (2002):** 202 neonates, water only bath 2x/week; pH ↓, ↑ SCH over first 4 weeks, desquamation on cheeks, forehead
- **Bartels (2010):** RCT 60 neonates (water, gel wash, crème after water, crème after gel wash); TEWL, SCH better when emollients used
- **Lavender (2013):** RCT 307 neonates, water vs liquid baby wash; no difference in TEWL, pH, SCH at 2 and 4 weeks; moms preferred using baby wash
Our “First Bath” Study (2012-13)

- 100 babies randomized to first bath with water alone or water with liquid baby wash
- 50 vaginal birth, 50 C/S
- All babies immersed and swaddled in the bath
- Pre and Post-Bath:
  - pH
  - TEWL
  - stratum corneum hydration
  - Skin microbiome (baby, mom)
  - Baby’s temperature
  - Water pH, hardness
Routine Bathing

- Use mild baby wash
  - Neutral or mildly acidic pH
  - Proven to have minimal impact on pH of skin
  - Proven ocular safety
- Bathe every other day or less frequently, although this may be influenced by cultural factors
- Avoid rubbing, use rinsing or immersion instead
- Prematures < 32 weeks, use water only for first 2 weeks
Emollients

- Preserve, protect, and enhance the skin barrier
- Role in healthy newborn skin care not clear
- Considered first-line treatment for Atopic Dermatitis
- Parents taught “Soak and Seal” method
  - bathe children with AD for a few minutes, not more than 2-3 times per week, using a moisturizing non-soap cleanser
  - use an emollient after bathing to seal in hydration
What is Atopic Dermatitis?

- Allergic inflammatory skin condition-results in dry, scaly skin
- Affects about 20% of children; 60% of those by their first birthday
- AD that arises in childhood is frequently a precursor of allergic asthma and allergic rhinitis
- Cause is a combination of genetic and environmental factors
- Keeping skin barrier intact may possibly prevent disease progression by inhibiting entry of allergens and irritants
- BEEP study: Barrier Enhancement for Eczema Prevention
Skin Disinfectants

- Chlorhexidine gluconate (CHG)
  - 2% CHG aqueous
  - 2%, 3.15% CHG in 70% isopropyl alcohol
  - 0.5% CHG in 70% isopropyl alcohol
- Povidone Iodine (PI)
- Isopropyl Alcohol (IA)
New FDA Labeling (2013) for CHG/isopropyl alcohol agents

“Use with care in premature infants less than 2 months of age. These products may cause irritation or chemical burns.”
Disinfectant Issues: Toxicity

- PI shown to cause thyroid abnormalities in premature infants
  - Smerdley (1989); Parravicini (1996); Mitchell (1991); Linder (1997)
- CHG toxicity: rare reports
  - Ocular and corneal damage
  - Reports of anaphylaxis in adults with impregnated catheters
  - Frequent surgical exposure
Disinfectant Issues: Efficacy

- **Adults**: CHG reduced risk for catheter-related blood stream infection by 49%; Chaiyakunapruk (2002)
  - CDC strongly recommends 2% CHG/70% isopropyl alcohol used for insertion of CVC, dressing changes
  - CVC in adults average 7-10 days duration

- **Neonates**: CHG reduces skin colonization, reduces contaminated blood cultures, no evidence for reducing blood stream infection Garland (2009)
  - CVCs in neonates have longer dwell times
  - Care of IV tubing, accessing IVs may be more important to prevent infection Mermel (2011)

- Isopropyl alcohol least effective at reducing bacterial colonization, very irritating Maki (1991)
Chemical Burns:
Povidone-iodine + isopropyl alcohol
Chemical Burns:
2% CHG with 70% Isopropyl Alcohol
Case Reports:
CHG chemical burns, erosive contact dermatitis

- Reynolds (2005)
  - 0.5% CHG/methanol
- Mannan (2007)
  - 0.5% CHG/isopropyl alcohol
- Espuny (2010):
  - 0.5% /methanol
- Anderson (2005):
  - 2% aqueous CHG caused erythema, breakdown in 4/36 infants <1000g, <48 hours of age
- Kutsch & Ottinger (2014)
  - 2 cases using “a chlorhexidine solution”; “CHG liberally applied”
- Weitz (2013):
  - Erosive contact dermatitis from CHG-impregnated gel dressings
Disinfectants

• Remove completely with water or saline
  – Avoid using isopropyl alcohol-containing disinfectants

• Most vulnerable to chemical burns are the extremely low birth weight infants (<1000 grams) in the first weeks of life
  – There is insufficient evidence to recommend a single disinfectant for use in all NICU patients, all invasive procedures
Anatomic Differences in Neonatal Skin: Cohesion Between Epidermis and Dermis

- Top two layers of skin connected by fibrils
- Fewer and further apart in premature infants
- Adhesives can attach more securely to epidermis than the epidermis is attached to the dermis

(Fetal Skin: Structure and Function, 1982)
The MARSI Project

- Consensus statements published in JWOCN in July 2013 about the risk of skin injury from medical adhesives

- In 2001, an evidence-based practice project evaluating the first Neonatal Skin Care Clinical Practice Guideline found:
  - Adhesive removal was primary cause of skin breakdown

Medical Adhesive-related Skin Injury: MARSI

- Skin Stripping
Medical Adhesive-related Skin Injury: MARSI

- Skin Tears
Medical Adhesive-related Skin Injury: MARSI

- Tension Blisters
- Contact Dermatitis
Medical Adhesives in the NICU

- Acrylates (Transpore™, cloth)
- Zinc oxide (pink tape)
- Hydrocolloids (Duoderm™)
- Hydrogel (electrodes)
- Polyurethane (transparent dressings)
- Silicone
Silicone Adhesives

- Adhere well to skin, hair
  Gentle when removed, can be replaced
- Won’t stick to plastic!
Silicone Tape in High Humidity
Adhesive Removal
Bonding Agents

- Tincture of Benzoin, Mastisol
  - Used to enhance adhesion of wound closure tapes
  - Not recommended in newborns, can increase epidermal stripping

MASTISOL® is a registered trademark of Eloquest Healthcare, Inc.
Barrier Films

- Plastic polymers sprayed or wiped on skin to protect from trauma
- Alcohol-free products less irritating to skin
- Cavilon is FDA approved in infants >30 days as diaper dermatitis treatment
- Other manufacturers do not need FDA label, covered under the original patented product
Adhesive Removers

Alcohol/organic-based solvents
  Contain hydrocarbon derivatives or petroleum distillates
  Toxicity
  Case report of skin injury and hemorrhage in premature infant after exposure to Detachol

Oil-based solvents
  Paraffin based (mineral oil), some citrus-based
  Leave oily residue, cannot replace adhesive

Silicone-based removers
  Safest medical adhesive remover
Diaper Dermatitis

- Irritant contact diaper dermatitis (IDD)
- Candida (fungal) diaper dermatitis
- Combination
Factors in Irritant Diaper Dermatitis

**Wetness:**
Macerates stratum corneum, impairs barrier function

**Friction:**
trauma from skin-to-diaper contact

**Urine and feces:**
Fecal ureases release ammonia, ↑ skin pH
Activates proteases and lipases, disrupts epidermis

**Risk factors:**
Malabsorption (short bowel syndrome, NAS)
Fecal incontinence (Hirschsprung’s, lack sphincter tone)
Atopic dermatitis (altered barrier function)
Wearing diapers!
Preventing Diaper Dermatitis

• Frequent diaper changes in first month
  – q 1-3 hours
• Superabsorbant disposable diapers offer some benefit, keep surface drier
• Bathing shown to restore acid mantle temporarily (Visscher 2002)
• Diaper holiday
• Role of petrolatum ointment?
• Wipes?
Diaper Wipes

• Visscher (2009):
  – 130 NICU infants, 23-41 weeks, 30-51 weeks when studied
  – RCT: wipe A, wipe B or cloth/water
  – TEWL, erythema better with wipes; pH lower with wipe B (acidity as preservative)

• Lavender (2012)
  – 280 full term neonates, measurements at 48 hours and 4 weeks
  – randomized to wipes vs. cotton wool/water
  – No difference in SCH, TEWL, pH
  – Mothers reported more “napkin rash” in the water group
Factors in Premie Diaper Dermatitis?

- Breastmilk fortifiers?
  - Powder
  - Liquid
Contact Irritant Diaper Dermatitis: Create a Barrier

“like frosting-on-a-cake”
Diaper Dermatitis Treatments
Diaper Dermatitis Remedies

• Affected skin is more permeable, ingredients may be absorbed
• Fewer ingredients better
• Some ingredients can cause contact dermatitis or sensitize as a potential allergen
• Mixing a bunch of products together may not be better
• Vigorous efforts to remove skin barriers can also injure skin that is trying to heal
• Cholestyramine mixed with emollient may be helpful for infants with short bowel syndrome
Candida Diaper Rash

• Fiery red, satellite lesions
• Distributed on thigh, perineum
• Treat with antifungal agents
Combination Diaper Rash

Antifungal powder
Seal powder on with skin protectant
“Crusting” technique
Can then apply thick layer of pectin barrier
Treat the Underlying Cause!

Diarrhea from malabsorption, opiate withdrawal, infection
May need change in formula to reduce frequency of stooling
Beginning at the Bottom: Evidence-based Care of Diaper Dermatitis
Heimall et al (2012); MCN 37:10-16

Survey at a children’s hospital showed 24% infants had diaper dermatitis

Nurses were inconsistent with treatment, not evidence-based

Protocol recommends frequent diaper changes, super-absorbent diapers

Visual chart with grading system, treatment options for consistency among nurses

Using products correctly!
Figure 2. PERINEAL SKIN CARE GUIDELINES FOR ALL DIAPERED/INCONTINENT PATIENTS. COPYRIGHTED BY THE CHILDREN'S HOSPITAL OF PHILADELPHIA. USED WITH PERMISSION.

<table>
<thead>
<tr>
<th>Skin Assessment</th>
<th>Intact skin</th>
<th>Intact skin</th>
<th>Intact skin</th>
<th>Intact skin</th>
<th>Denuded skin*</th>
<th>Denuded skin*</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ No erythema</td>
<td>+ No erythema</td>
<td>+ High risk for skin breakdown due to causticity of stool (short gut, post pull through or ostomy closure)</td>
<td>+ With or without erythema</td>
<td>+ Intact skin</td>
<td>+ Evidence of Candida**</td>
<td>+ Evidence of Candida**</td>
</tr>
<tr>
<td>Goal of Treatment</td>
<td>Prevent skin breakdown</td>
<td>Prevent skin breakdown; Provide barrier</td>
<td>Prevent skin breakdown; Provide barrier</td>
<td>Prevent skin breakdown; Treat Candida; Provide barrier</td>
<td>Prevent further skin breakdown; Treat Candida; Provide barrier</td>
<td>Prevent further skin breakdown; Treat Candida; Provide barrier</td>
</tr>
</tbody>
</table>

No-Sting Barrier film may be applied prior to application of any of the below products (in patients > 28 days old)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Vaseline</th>
<th>Triple Paste OR Ilex then Vaseline</th>
<th>Destin</th>
<th>Antifungal then Destin</th>
<th>Stomahesive powder then Triple Paste OR Stomahesive powder then Ilex then Vaseline OR One of the above plus &quot;crusting technique&quot;</th>
<th>Antifungal then Triple Paste OR Antifungal then Ilex then Vaseline OR One of the above plus &quot;crusting technique&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Instructions</td>
<td>Apply a thick layer of Vaseline over the entire area to be protected (think &quot;icing on a cake&quot;)</td>
<td>Apply a thick (think &quot;icing on a cake&quot;) layer of Triple Paste or Ilex. For Ilex: “Press” into place rather than “spreading”. - Apply a thick layer of Vaseline on top of Ilex. Vaseline prevents Ilex from sticking to diaper. With each diaper change: - Only remove stool, try to leave layer of Ilex/Vaseline in place. - Replace the product that came off: - Skin showing: Replace Ilex, then Vaseline. - Ilex showing: Replace Vaseline.</td>
<td>Apply a thick layer Destin over the entire area to be protected. (think &quot;icing on a cake&quot;)</td>
<td>Apply antifungal, then apply a thick layer of Destin over the entire area to be protected. (think &quot;icing on a cake&quot;)</td>
<td>Apply a thin layer of Stomahesive powder to denuded areas. Brush off excess. Powder will stick to the open skin. Then apply thick layer of Triple Paste OR Ilex (press into place) on top of Stomahesive powder. For Ilex: - Apply a thick layer of Vaseline on top of Ilex. Vaseline prevents Ilex from sticking to diaper. With each diaper change: - Only remove stool, try to leave layer of Ilex/Vaseline in place. - Replace product that came off: - Skin showing: Replace Stomahesive powder, then Ilex, then Vaseline. - Ilex showing: Replace Vaseline. Crusting Technique: Stomahesive powder, then seal with No Sting, repeat, then layer Triple paste or Ilex/Vaseline</td>
<td>Follow application instructions at left using antifungal powder in place of Stomahesive powder.</td>
</tr>
</tbody>
</table>

*Denuded Skin: Skin with moist, open, oozing ulcerations.
**Candida infection: Brawny red skin with oval/doty lesions scattered at edges (satellite lesions), usually involves skin folds, skin may or may not be denuded.
NOTE: These products promote moist wound healing, therefore do not leave diaper open to air or have air/oxygen blowing on diaper area.
†Source: ©Douglas Hoffman, MD, Dermatlas; http://www.dermatlas.org
Conclusions

• Goal: protect neonatal skin and promote future skin health
• Skin microbiome protects skin from infection, disease
• Bathing best practices not clear
  – water alone may not be better than using gentle baby wash
  – CHG bathing in neonates?
• Still not sure about the best skin disinfectant for neonates
• Preventing skin damage from diaper dermatitis and medical adhesives is optimal