Skin Care for the Neonatal and Pediatric Patient: What’s New?

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Disclosures

• No financial disclosures
• Will discuss off-label uses of some products
Objectives

- Review anatomy of the skin and differences between newborn, pediatric and adult skin.
- Define MARSI (medical adhesive related skin injury) and strategies to reduce these injuries while maintain adhesion for critical tubes and lines.
- Discuss prevention and treatment for diaper dermatitis.
- Identify practices to improves care for gastrostomy tubes.
- Review current wound care strategies and products.
Skin Layers

- Epidermis
- Dermis
- Subcutaneous tissue
- Stratum Corneum
- Basal Layer

- Hair follicle
- Sebaceous gland
- Sweat gland
Stratum Corneum: Comparison of Adult, Term and Premature Infant

- 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)
Neonatal Skin: Anatomic and Functional Differences

• Neonatal stratum corneum 30% thinner than adult, epidermis 20-30% smaller
• Keratinocyte cells smaller, higher cell turnover rate → wounds heal faster!
• Dermis has shorter collagen fibers, absent reticular layer → skin feels softer
Cohesion Between Epidermis and Dermis

Top two layers of skin connected by fibrils

Fewer and further apart in premature infants

Implications for adhesive removal

(Fetal Skin: Structure and Function, 1982)
Medical Adhesives in the NICU

- Acrylates (Transpore™, paper, cloth)
- Zinc oxide (pink tape)
- Hydrocolloids (Duoderm™, Brava™)
- Hydrogel (electrodes)
- Polyurethane+acrylate (transparent dressings)
- Silicone
Disruption of Barrier Function Associated With Adhesive Removal


- 30 infants, 26-40 weeks, <7 days of age
- Significant alteration in skin barrier after removal of acrylate-based tape and hydrocolloid
  - TEWL, color, visual assessment
- Hydrogel fell off in 7 infants before 24 hours
- Changes seen in big as well as small babies
The MARSI Project

- Consensus statements published in *Journal of Wound Ostomy and Continence Nursing* 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: MARSII

- Skin Stripping
Medical Adhesive-related Skin Injury: MARSI

- Skin Tears
- Blisters
Medical Adhesive-related Skin Injury: MARSI

- Contact Dermatitis
Alternative Dressings for CVCs

- Tegaderm HP instead of regular Tegaderm
- Other brands (Mepore, Biocclusive, OpSite)
- Silicone dressing impregnated with chlorhexidine diacetate + silver sulfate (IV Clear from Covalen)
Post Inflammatory Hyper- and Hypopigmentation

• Results from irritated, inflamed or injured skin
• Treatment has not been identified
• Skin heals and pigment returns within 6 months, sometimes longer
• Prevention of skin irritation and inflammation may prevent PIH from returning
Silicone Adhesives

- Adhere well to skin, hair
  Gentle when removed, can be replaced
- Won’t stick to plastic!
Silicone Tape and EEGs
Silicone Tape in High Humidity
Adhesive for critical tubes and lines: adheres well in moist settings
Bonding Agents

- Tincture of Benzoin™, Mastisol™
- Used to enhance adhesion of wound closure tapes
- Routine use under tape not recommended in newborns, can increase epidermal stripping

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

• Plastic polymers sprayed or wiped on skin to protect from trauma
• Alcohol-free products less irritating to skin
• Cavilon™, No-Sting™ skin protectant
Silicone Barrier Films
Tips for Safer Adhesive Removal

• Peel adhesive back parallel to skin surface instead of straight up
• Hold skin surface next to adhesive.
• Use mineral oil, petrolatum ointment if no need to reattach appliance.
• Transparent dressings: stretch to release adherence
• Consider use of silicone adhesive removers
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
  Probably the safest medical adhesive remover

Black 2007
Silicone Adhesive Removers
Diaper Dermatitis

Irritant contact diaper dermatitis (IDD)

Candida (fungal) diaper dermatitis

Combination
Factors in Irritant Diaper Dermatitis

**Wetness:**
Macerates epidermis, impairs skin barrier

**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 skin pH (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
Contact Irritant Diaper Dermatitis: Create a Barrier

“like frosting-on-a-cake”
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 is not better!
• Vigorous efforts to remove diaper rash agents can also injure skin that is trying to heal
Severe Excoriations: Sensicare, Ilex, Cavilon Advance

- Sensicare, Ilex contain carboxymethylcellulose, sturdier barrier
- Once a day “sitz bath”; dry skin completely
- Apply thick coating to excoriated skin; if Ilex, allow to “dry” 30 seconds
- Cover Ilex with coating of petrolatum so that diaper doesn’t stick
- After stooling, remove as much soil as possible, don’t expect to remove all
- It will look kind of gross, but re-apply barrier to keep skin covered, protect from “re-injury”
- Consider Cavilon Advance for severe excoriation, reapply every 5-7 days
Severe Irritant Diaper Dermatitis
24 Hours after Cavilon Advance Applied
“Super Skin Barriers”
Acrylic Polymers+2-octyl Cyanoacrylate
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 Ilex paste
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!
### Perineal Skin Care Guidelines for Diapered and/or Incontinent Patients

<table>
<thead>
<tr>
<th>Skin Assessment</th>
<th>Intact Skin</th>
<th>Intact Skin</th>
<th>Intact Skin</th>
<th>Denuded skin</th>
<th>Denuded skin</th>
<th>Intact Skin</th>
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<tbody>
<tr>
<td></td>
<td>-No erythema</td>
<td>-No erythema</td>
<td>-No erythema</td>
<td>-No fungus</td>
<td>-Evidence of fungal rash</td>
<td>-High risk for skin break-down due to causticity of stool (e.g. high-dose chemotherapy, GI GVHD or history of severe breakdown that is difficult to treat)</td>
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<tr>
<td>Goal(s) of Treatment</td>
<td>Prevention</td>
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**No-Sting Skin Prep** may be applied prior to application of any of the below products in patients > 28 days old. 

**Na Sting Skin Prep** adheres best to intact skin - consider Stomahesive Powder as alternative to skin prep in conditions with loss of skin integrity.

#### Treatment

- **Aquaphor**
- **Desitin Maximum Strength** or **Z-Guard**
- **Sensi-Care Barrier Cream**
- **Sensi-Care Barrier Cream**, or Stomahesive powder, then Ilex, then Aquaphor®
- Nystatin powder, then Na Sting Skin Prep®, or Nystatin powder, then Ilex, then Aquaphor®
- **Sensi-Care Barrier Cream** or Ilex, then Aquaphor®

#### Hints for Use

- Apply a thick layer over the entire area to be protected (**"Icing on a cake"**) or consider No Sting Skin Prep. Apply a thick layer over the entire area to be protected (**"Icing on a cake"**).
- Apply anti-fungal ointment to small discreet areas or anti-fungal powder to large disseminated areas with evidence of fungus (the powder will adhere to denuded skin areas). Then, apply a thick layer (**"Icing on a cake"**), of Sensi-Care Barrier Cream or Ilex followed by Aquaphor.
- Apply a thick layer (**"Icing on a cake"**) of Sensi-Care Barrier Cream or Ilex, then apply Aquaphor.
- Illex-specific instructions: Apply a thick layer of Ilex. "Press" Ilex into place rather than trying to spread it. Then, apply a thick layer of Aquaphor to prevent diaper from sticking to Ilex.

- **Denuded skin**: Skin with moist, open, oozing ulcerations
- **Fungal rash**: Beuffy red skin with oval/dotty lesions scatter at edges (satellite lesions), usually involves skin folds, skin may or may not be denude
- **When cleansing denuded/non-intact skin**: wipe off only the ointment/cream that is "stained" with stool using a gentle patting motion. Never scrub /strip the stool from the skin as it will only further irritate or denude the area. Then reapply treatment ointment/barrier creams as necessary.
- **All mentioned products** promote moist wound healing, therefore do not leave diaper open to air or have air/oxygen blowing on diaper area.
- **CHG-compatible product** for patients with a CVC/PICC or other deep-line in place.
- **It is acceptable to select a product based on past treatment or parent preference. Ensure at least 72 hours of product use to evaluate effectiveness before changing plan**.
- **Documentation Q.Shift**: nursing care plan reflects accurate and up-to-date plan; nursing notes reflect perineal skin assessment and care provided.

Adapted from Children's Hospital of Philadelphia, 2009
GASTROSTOMY ISSUES
Button Gastrostomy Tubes

MicKey

AMT MiniOne

Measuring Device

Bard Button
Skin Issues with Gastrostomies

- Hypergranulation tissue
- Peristomal skin irritation
- Candidiasis
- Cellulitis
Hypergranulation Tissue

- Causes include foreign body, movement of tube, moisture
- Avoid occlusive dressings
- Ensure that button fits appropriately (shaft), does not move excessively
- Secure extension sets
- Treatment includes triamcinolone cream, silver nitrate, surgical excision
- Hypertonic saline, salt
Gastrostomy Best Practices

- Rotate button 180 degrees BID
- Secure continuous feeding extension sets with “pinch-tape” method to prevent rocking of button inside stoma, as this can contribute to granulation
- If bolus feeds, remove extension set after feeding
Gastrostomy: To Dress or not to Dress?
Gastrostomy Best Practices

• Proper sizing and adequate balloon inflation
  – “sealed system” between balloon and abdominal wall

• **Dressings not necessary**
  – Unless shaft is too long, then may need something
  – Problem is dressings become moist, may macerate the skin unless changed frequently
  – No Sting skin protectant may be helpful

• If leaking, check balloon water volume
  – Frequency of checking
Other Complications

- Cellulitis (sometimes from external sutures)
- Wound separation
- Leaking gastric fluid
- New or increased emesis
  - May be due to where the balloon sits in the stomach
  - In one case, the balloon obstructing pylorus
Gastrostomy with Breakdown

• Antimicrobial ointment
• Silicone dressing
Excoriation from Gastric Fluid
Complications: Wound Separation

Treated with Aquacel Ag tucked into the wound; Keflex
Also, NJ feeds until healed
WOUND CARE
Wound Healing Principles

• Wounds heal faster with less involvement of epithelial tissue, and thus less scar tissue, when kept moist
• Three phases: inflammatory, proliferative, maturation
• “Never put anything on a wound that you wouldn’t put in your eye”
• Avoid use of disinfectants, cleansers in wound
Wound Care Dressing Categories

- Absorption dressings
- Alginites
- Debriding agents
- Foams/composites
- Gauze
- Honey
- Hydrocolloids
- Hydrogels
- Silicone
- Transparent films

Excellent article:
Hydrogel Dressing

Hydrocolloid window + hydrogel

Hydrocolloid

Composite with silicone border

Silicone dressing + ointment

Silicone foam dressing
Effects of Petrolatum on Stratum Corneum Structure and Function

- Adult skin injured with acetone
- Applied petrolatum BID
- Used TEWL to measure changes in barrier function
- Improved barrier function (TEWL) with petrolatum
- May organize intracellular bilayers, improve initial healing process
- Grease is good!
Neck Breakdown:
Ointment + Silicone Dressing
The Evidence Supporting the Use of Honey as a Wound Dressing
Molan PC (2006) 5:40-54

- RCTs (not blinded), clinical trials, case reports
- Debrides wounds, reduces edema and exudate
- May have antibacterial, anti-inflammatory action
- Some are manufactured from honey not selected to have high levels of antibacterial activity
- Case reports in neonates
Wound Dehiscence
Irrigate Wound  Protect Surrounding Skin
Apply Skin Barrier
Absorbent Polyurethane Dressing
Dressing Before and After
Dressings Containing Silver

• Antibacterial activity from cell membrane disturbance that inhibits cell division and multiplication
• Case studies available in neonates
• Mepitel Ag
• Aquacel Ag
Wound Vac
How Does the Wound Vac Work?  
(Not sure I really understand this…)

• Negative pressure produces macrostrain and microstrain  
  – Macrostrain: visible stretch, occurs when negative pressure contracts the foam  
  – Microstrain: microdeformation at cellular level, leads to cell stretch  
    • Decreased edema, better perfusion, promotes granulation by facilitating cell migration and proliferation

• Still need to work out which wounds will benefit from this therapy

• www.kci1.com/KCI1/sciencebehindthetherapy#howitworks
Conclusions

• Neonatal skin is different than older children and adult skin
• Prevention of MARSI is desired and applies to patients across the lifespan.
• Strategies for prevention and treatment for diaper dermatitis can be standardized for optimal results
• Best practices for care of gastrostomy tubes can prevent some complications
• Wound care involves moist healing in most cases and utilize a variety of products.