

Neonatal Nursing Education Brief: Improving Neonatal Skin Care

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Human skin functions in a variety of ways. It provides barrier protection, safety from infection, and thermal stability. Neonatal skin is immature at birth, and slowly approaches adult function. Skin immaturity places neonates at risk for injury in the NICU. However, prevention is possible.

NICU, neonatal, skin care, medical adhesives, skin injury, preterm infants

Improving Neonatal Skin Care

Purpose and Goal: CNEP # 2110

- Learn about the characteristics of neonatal skin
- Learn about the risks of neonatal skin injury in the NICU

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Requirements for successful completion:

- Successfully complete the post-test
- Complete the evaluation form

Date

- July 2019 – July 2021

Learning Objectives

- Describe the structure and function of skin
- Describe the unique structure of neonatal skin
- Describe 2 options for preventing skin injury in the NICU

Introduction

- Skin is a major protector from infection
- It is immature at birth and is at risk for injury
- Exposure to potential injury in the NICU is common
- However, it is possible to minimize exposure to risks
- It is also possible to prevent neonatal skin damage

The Function of Human Skin

- Human skin functions in several ways
 - Barrier protection
 - Tactile sensation
 - Thermal regulation
 - Acid mantle formation
- Skin protects internal organs
- Skin offers barrier protection against
 - Irritants
 - Bacteria
 - Allergens
 - Potential toxins
- Skin provides tactile sensory input
 - Sensations of touch
 - Sensations of pressure
 - Sensations of temperature

- Sensations of pain and itch
- Skin regulates insensible water loss
- Skin secretes electrolytes and water
- Skin plays a major role in the storage of fat
- Skin plays a major role in thermoregulation

The Layers of Human Skin

- Skin is composed of 3 layers
 - The epidermis
 - The dermis
 - The hydrodermis
- The epidermis is comprised of two distinct layers
- The outermost layer of the epidermis
 - Is the stratum corneum
 - A non-living layer
 - Made up of dead cells
 - Constructed like a wall of bricks
 - It continuously sloughs dead cells
 - The stratum corneum
 - Forms part of vernix caseosa
 - Controls transepidermal water loss
 - Prevents absorption of toxic substances
- The deepest layer of the epidermis
 - Is the basal layer
 - It is the bottom layer
 - Adjacent to the junction
 - Of epidermis and dermis
 - It is made up of living cells
 - That replace sloughed cells
 - New cells push older cells up
 - Toward the surface of skin
 - It is a source of renewal for the epidermis
- The dermis is the layer underneath the epidermis
 - It is composed of collagen

- It is composed of elastin fibers
- It contains several important items
 - Nerves
 - Mast cells
 - Blood vessels
 - Lymph vessels
 - Inflammatory cells
- It is the carrier of heat, pressure and pain
- It is thin and not well developed in the neonate
- The hydrodermis is the subcutaneous layer
 - It is composed of fatty connective tissue
 - It functions as many things
 - Heat insulator
 - Shock absorber
 - Caloric reservoir
 - Fat deposits occur in the third trimester

The Anatomy of Neonatal Skin

- All infant skin structure/function is immature at birth
- The epidermis has fewer layers of stratum corneum
- The stratum corneum is “visibly mature” in term infants
 - But term skin is 30% thinner than adult skin
 - Premature skin is 40-60% thinner than adult skin
 - Thinner skin allows for increased permeability
- Adult skin has 10-20 layers of stratum corneum
 - Term infant skin has fewer layers
 - Premature infant skin has even fewer layers
 - <30 week skin → 2-3 layers of stratum corneum
 - 23-24 week skin → 0 layers of stratum corneum
- Full barrier protection does not exist
 - Until 2-4 weeks in most infants
 - Until 8-9 weeks in VLBW infants
- The maturation rate varies dependent on gestational age

- 23-25 weeks it takes 8-10 weeks to mature
- <27 weeks the process remains slowed
- 27-40 weeks it takes 10-14 days to mature
- Functional skin maturity can take weeks – months
 - The risks of underdeveloped skin include
 - Infections
 - Skin irritation
 - Increased water loss
 - Increased absorption of toxins
 - Epidermal skin stripping
- An immature basal layer can lead to epidermal stripping
 - The dermis-epidermis is connected by fibrils
 - The fibrils are fewer and more widely spaced
 - Fibrils become stronger with time and age
- The risks of underdeveloped fibrils include
 - Increased bond of adhesives to thin epidermis
 - Decreased adhesion between dermis-epidermis
 - Leads to epidermal stripping with adhesive removal
- An immature dermis places the infant at risk of injury
 - Fewer collagen and elastin fibers
 - Leads to increased risk of edema
 - Edema leads to increased risk of
 - Ischemic injuries
 - Pressure necrosis
 - Decreased blood flow

The Characteristics of Infant Skin

- Neonatal skin appears soft, wrinkled, velvety
 - Premature skin is transparent
 - Lanugo and vernix are present
 - Subcutaneous edema may be present

- Neonatal skin has an alkaline surface
 - Term skin pH is 6.3 at birth
 - pH falls to 4.95 within 4 days
 - Which creates an “acid mantle”
 - Premature skin pH is >6.0 at birth
 - pH falls to 5.5 over first week
 - pH falls to 5.0 over the first month
 - Diapered area pH is 4.7
 - Adult skin pH is 4.7
 - A low pH forms an “acid mantle”
 - The acid mantle is protective
 - Transient flora are inhibited
 - Resident skin flora grow at pH >4.7
- Neonatal skin may have altered nutritional stores
 - Fat and zinc accumulate in the 3rd trimester
 - Premature infants at risk for fatty acid deficiency
- Neonatal skin is more vulnerable to infections
 - Immature immune system
 - Invasive tubes and catheters
 - Frequent use of antibiotics
 - Immature skin structure
 - Immature skin function
 - Excoriation and trauma
 - Changes in skin pH

Skin Protection in Neonates

- NICU care exposes immature skin to risks
 - Toxicity from skin disinfectants
 - Damage from pressure injuries
 - Stripping from medical adhesives
 - Acid mantle disruption from bathing
- The goals of skin care include
 - Maintain skin integrity
 - Reduce traumatic injury

- Avoid exposure to toxins
- Minimize exposure to irritants

Skin Toxicity in Neonates

- Neonatal skin has an increased risk of toxicity
 - From commonly used skin disinfectants
- This is due to several factors
 - An increased absorptive surface
 - An increased ratio of surface area/weight
 - A lack of subcutaneous fat
 - Which leads to a reduced buffer
 - And a redistribution of fat soluble drugs
 - An immature blood brain barrier
 - An immature detoxification system
 - Immature liver
 - Immature kidneys
- There are 3 main skin disinfectants used in neonates
 - Chlorhexidine gluconate
 - Povidone iodine
 - Isopropyl alcohol
- Chlorhexidine gluconate
 - Chlorhexidine aqueous
 - Chlorhexidine in 70% alcohol
 - Chlorhexidine reduces skin colonization
 - It also reduces contaminated blood cultures
 - Effective against Gram + and Gram – organisms
 - No evidence it reduces blood stream infections
 - FDA Warning: use with care in infants <2 months
 - It has been found in the serum of neonates
 - With accumulative effects over time
 - Due to increased absorption

- Due to decreased elimination
 - Highest levels 2-3 days after use
 - Known to cling to stratum corneum
 - Chlorhexidine baths not routinely recommended
 - Side effects include
 - Chemical burns
 - Contact irritant dermatitis
 - Occasional anaphylaxis
- Povidone iodine
 - Also known as Betadine
 - Betadine reduces skin colonization
 - It also reduces contaminated blood cultures
 - No evidence it reduces blood stream infections
 - Iodine can interfere with preterm thyroid function
- Isopropyl alcohol
 - Is very drying and irritating
 - Is least effective at reducing bacteria
- Best Practice for disinfectant use
 - Allow to dry for procedure
 - Avoid excessive use or pooling
 - Remove with sterile water or saline
 - Following the procedure
 - Avoid using alcohol products
- There is no evidence to recommend any one product

Pressure Injuries in Neonates

- Pressure injuries are common in neonates
- They frequently occur in infants requiring
 - Cardiorespiratory monitoring
 - Respiratory support equipment
 - The use of medical adhesives

- They also frequently occur in infants with
 - Altered perfusion
 - Edematous skin
 - Altered blood pressure
- Most commonly affected areas include
 - Head
 - Face
 - Nares
 - Ears
 - Legs
- Best Practice for prevention includes
 - Monitor skin regularly
 - Use protective padding
 - Snuggle up
 - Bendy Bumper
 - Gel or ZFlow mattress
 - Change position frequently
 - Allows for increased visibility
 - Decreased prolonged pressure
- Best Practice for Reduced risks includes
 - Use appropriate sized oxygen devices
 - Rotate CPAP mask and prongs
 - Use skin protection under CPAP
 - Change pulse oximeter probe regularly
 - Avoid leaving BP cuffs on infants
 - Change use cotton underneath IV catheters
 - Monitor all tape frequently
 - Loosen tight tape as needed

Adhesive Injuries in Neonates

- Skin stripping is common in neonates

- Related to the use of adhesives
- Common medical adhesives include
 - Medical tapes
 - Cloth
 - Pink tape
 - Transparent
 - Hydrogels
 - Monitor electrodes
 - Temperature probe covers
 - Hydrocolloids
 - Duoderm
 - Exuderm
 - Replicare
 - Polyurethane films
 - Opsite
 - Tegaderm
 - Bioclusive
- Skin stripping occurs with adhesive removal
 - The top 2 layers of skin are connected by fibrils
 - Fibrils are fewer and further apart in neonates
 - The epidermis is not securely attached to the dermis
- Removal can separate the epidermis from the dermis
 - Leaving areas of denuded skin
 - Leaving area without barrier protection
- Best Practice for prevention includes
 - Use smallest amount of tape
 - Use transparent film when possible
 - Use hydrocolloids under tape
 - Avoid use of Band-Aids for heelsticks
 - Use cotton or gauze
 - Peel adhesives parallel to the skin
 - Instead of straight up
 - Hold skin surface next to adhesive

- Provide support to the epidermis
- Use Vaseline or Aquaphor
- Use warmed saline wipes
- Stretch transparent film to release
 - Instead of peeling parallel
 - Instead of peeling straight up
- Remove adhesives slowly and gently
- Provide pain control measures during removal
- Prevention of medical adhesive related injury is possible
- OF NOTE: adhesive removers are *not* recommended
 - Several adhesive removers are available
 - Alcohol / organic-based solvents
 - Contain hydrocarbon derivatives
 - Contain petroleum distillates
 - Detachol is no longer considered safe
 - Case reports of IVH
 - Case reports of brain injury
 - Oil-based solvents
 - Mineral oil
 - Paraffin based products
 - Leaves an oily residue
 - Newer citrus-based products
 - *May* be the safest option for use
- OF NOTE: skin prep products are also *not* recommended
 - Use of hydrocolloid barrier is safest
 - Benzoin is no longer considered safe
 - Mastisol is no longer considered safe
 - Silicone barrier films are newer options
 - Plastic polymers sprayed or wiped on skin
 - Alcohol free products
 - Shown to be less irritating
 - Cavilon No-Sting was the first product
 - Only recommended if >28 days old

- *Not* recommended for routine use

Skin pH Injuries in Neonates

- Bathing is a common event in neonates
- Bathing should be done every few days
 - Immersion tub bath
 - Swaddled immersion bath
- All bathing causes an increased skin pH
- Tap water increased skin pH for up to 24 hours
- Bath products should be tested as safe for neonates
 - Avoid scented products
 - Avoid antimicrobial products
 - Preservatives *are safe* for use
- Bath products should be neutral or slightly acidic
 - Ideally with a pH 5.5-7.0
 - pH of bath products not currently available
- Avoid lengthy baths that overhydrate the skin
- There is no evidence to support one product over another

Diaper Dermatitis in the Neonate

- Diaper rash is a common problem in neonates
 - It is characterized by skin inflammation
 - It can cause pain and stress
 - For infants
 - For families
- It affects up to 24-40% of NICU neonates
- There are 3 common types of rash
 - Chaffing
 - Irritant contact

- Candidiasis
- Diaper dermatitis is multifactorial
- It is usually associated with irritants
 - Moisture
 - Fecal enzymes
 - Cleansing agents
 - Diaper materials
 - Diaper friction on skin
- The diaper area is predisposed to irritation
 - Over hydration
 - Higher skin pH
- The Diaper Dermatitis Cascade
 - Exposure to water / harsh cleansers damages skin
 - Fecal enzymes degrade the stratum corneum
 - Excess rubbing and cleansing strips skin
 - Skin irritants penetrate the epidermis
 - Neonatal skin has a thin epidermis
 - Penetration causes inflammation
 - Down to the epidermal basal layer
- Best Practice for prevention includes
 - Use dye free diapers
 - Use super absorbable diapers
 - Use soft disposable diaper wipes
 - Or a soft cloth
 - With soap and water
 - Avoid vigorous rubbing with cleaning
- Best Practice for management includes
 - Use Vaseline with *every* diaper change
 - Currently regarded as the gold standard
 - Use Desitin if diaper area is reddened
 - Use Nystatin as needed for candidiasis
 - Cream, ointment, powder
 - Seal powder with skin protectant

- Cover with a thick layer of Desitin
- Use stoma powder if area is denuded
 - Allow powder to dry and “crust”
 - Cover with a thick layer of Desitin
- Covering Nystatin or Stoma Powder
 - Prevents diaper from sticking
 - Prevents absorption by diaper
- In general, mixing several products together
 - Has not been shown to be effective
 - Is not better! Fewer products is best!
- Best Practice for management also includes
 - Leaving diaper area open to air
 - “Clean → Dry → Apply”
 - Dry before applying barrier
 - Dry before applying new diaper
 - Avoid removing barrier products
 - Just remove urine and stool
 - Consider a daily soap and water “Butt Bath”
 - Consider Cavilon No-Sting Barrier if >28 days
 - Consider Cavilon Advance for severe excoriation
 - Consider using honey if nothing else works
 - It debrides wounds
 - It reduces edema and exudate
 - It is thought to have antibacterial properties
 - It is thought to have anti-inflammatory properties

Summary

- Neonatal skin is different than adult skin
- It is easily prone to irritation and injury
- The goals of skin care are to
 - Prevent toxicity

- Preserve integrity
- Minimize exposure
 - To medical adhesives
 - To chemical irritants
- It is possible to avoid skin injury and damage
- Updated skin care guidelines direct Best Practice

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