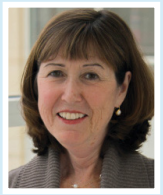
Research Review SPEAKER SERIES

Neonatal Nurses College of Aotearoa Conference

Making Education Easy

26-28 October 2016, Dunedin

About the Reviewer



Joanne Kuller
RN, MS
Neonatal Clinical Nurse Specialist

Ms Kuller has a 30-year career in neonatal care and is currently a neonatal clinical nurse specialist at UCSF Benioff Children's Hospital Oakland, California. She has written numerous articles and book chapters on neonatal skin care and has been involved in several clinical research projects assessing the barrier function of the neonate's skin.

Her special areas of research include the effects of adhesives, phototherapy, and the first bath on neonatal skin. Ms Kuller has been a member of the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) *Neonatal Skin Care Evidence-based Guideline* development team for all three editions.

Welcome to this review of the Neonatal Nurses College of Aotearoa Conference,

held in Dunedin on 26-28 October, 2016. Among others, the meeting featured presentations from keynote speaker Joanne Kuller, a Neonatal Clinical Nurse Specialist. Her presentations focused on evidence-based newborn skincare guidelines, development of the skin microbiome, and infant bathing and nappy rash.

OVERVIEW OF EVIDENCE-BASED NEWBORN SKINCARE GUIDELINES

The *Neonatal Skin Care Evidence-based Clinical Practice Guideline*[1] is a collaboration between two national nursing organisations in the US (AWHONN and National Association of Neonatal Nurses [NANN]). In writing the guidelines, more than 200 research articles on neonatal skin and skin care were reviewed and scored. The third edition was published in 2013 and includes new information on product selection, microbiome of the skin, parent education and atopic dermatitis. Ms Kuller gave delegates an overview of the evidence behind the guidelines.

Skin barrier function

The skin is comprised of three layers – the epidermis, the dermis and subcutaneous tissue (Figure 1). The most important layer in the newborn setting is the epidermis. The epidermis is comprised of two parts – the stratum corneum and the basal layer. The stratum corneum provides skin barrier function, protecting against toxins and microorganisms and retaining heat and fluid.

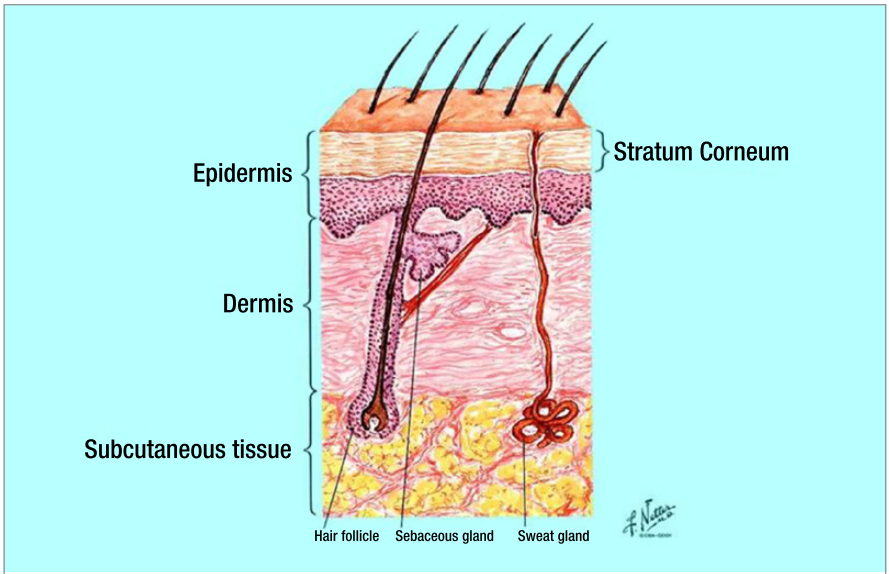


Figure 1. Cross-section of the skin

Skin barrier function can be measured by the skin's ability to hold on to water (i.e. reduce transepidermal water loss [TEWL]), stay hydrated, and regulate pH. Immaturity, alterations in pH, skin injury or disease can all result in impaired barrier function. The stratum corneum is often described as arranged like the bricks and mortar of a wall – the aim is to keep this 'wall' intact so that water loss does not occur, irritants cannot penetrate, and pH is maintained at around 5.0.

Differences between baby and adult skin

Thinner stratum corneum

In the adult, the stratum corneum has 10 to 20 layers. However, in the newborn and throughout the first year of life, the stratum corneum is about 30% thinner than that of adult skin and does not function as well. There are only about two or three layers of stratum corneum in a baby born at <30 weeks gestation, while babies born at 23–24 weeks gestation have virtually no stratum corneum and therefore a negligible barrier function, and high TEWL and heat loss. Directly beneath the stratum corneum is the basal layer of the epidermis and this is about 20% thinner than that of the adult. Keratinocyte cells in this layer have a higher turnover rate, which may account for the faster wound healing that has been observed in neonates.

Decreased cohesion between epidermis and dermis

The dermis in the newborn is thinner and not as well developed as the adult dermis. Collagen fibers are shorter and less dense, and the reticular layer of the dermis is absent, which makes the skin feel soft. Between the epidermis and dermis are fibrils that connect these two layers of the skin. In premature infants, the fibrils are fewer in number and more widely spaced than in full-term or adult epidermis. The implication of this developmental variation is that the top two layers of the skin of a premature infant are not well connected together. Therefore, an adhesive may adhere very tightly to the epidermis with a better bond between the adhesive and the epidermis than the epidermis has to the dermis. On adhesive removal there is a high risk of stripping off the entire epidermis.

Higher skin pH

Full-term newborns are born with an alkaline skin surface (pH > 6.0) but within 4 days the pH typically falls to < 5.0. The goal is to achieve a pH of ≈ 4.7, termed an 'acid mantle' which allows commensal bacteria to thrive on skin and inhibits the growth of pathogenic mircroorganisms. The skin pH in premature infants is about 5.5 by the end of the first week, and then decreases to 5.1 by the end of the first month. Bathing in normal tap water and other topical treatments transiently affect skin pH, and skin covered by nappies has a higher pH (≈ 6.0) because of the combined effects of urine and occlusion. Increasing alkalinity increases skin permeability meaning a higher water loss and greater chance of irritants entering the skin barrier.

Unique differences in infant skin

- Baby stratum corneum is 30% thinner than adult, epidermis is 20–30% smaller
- Keratinocyte cells are smaller with higher cell turnover rate; explains faster wound healing in babies
- Dermis is also different; short collagen fibers, absent reticular layer, makes skin feel softer
- Baby skin contains less total lipids and less sebaceous lipids, confirming the decreased activity of glands

Strategies to decrease water and heat loss from the skin

Care practices for the hospitalised infant can place them at risk for compromising skin integrity. Skin breakdown can lead to systemic infection, increased morbidity, and increased cost of care.

Some of the strategies used in NICU to reduce TEWL and evaporative heat loss include plastic hats, wrap or bags, supplemental conductive heat such as heated mattresses, incubators rather than radiant heaters, keeping humidity >70%, transparent adhesive dressings and emollients. A study in extremely low birthweight (ELBW) infants who were placed in hybrid incubators with increased humidity showed a reduction in several parameters including fluid intake, urine output, weight loss, hypernaturaemia, severe bronchopulmonary dysplasia, and duration of assisted ventilation, along with improved growth rate.[2]

Preventing atopic dermatitis

Rates of atopic dermatitis (AD) are increasing around the world, affecting about 20% of children; 60% of those by their first birthday. AD is caused by skin barrier disruption, as a result of a complex interaction between genes and negative environmental factors that break down the skin barrier. Allergens can then enter the skin and AD develops. AD may lead on to other diseases such as food allergies, asthma, and hay fever; this process is known as the 'atopic march' (Figure 2). Keeping the skin barrier intact may prevent disease progression by inhibiting entry of allergens and irritants.

AD can be prevented by changing the environment a new born baby is exposed to from negative to positive. Importantly, a window of opportunity exists in the first few months after birth to change the environment to prevent the development of AD. Everything put on a baby's skin from birth should be designed to enhance the skin barrier rather than damage it.

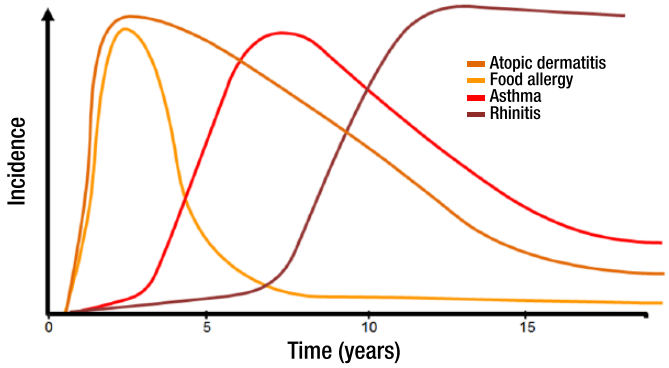


Figure 2. The atopic march

Emollients and disinfectants

Emollients preserve, protect, and enhance the skin barrier and are considered first-line treatment for AD. Petrolatum-based emollients are gold standard to retain surface hydration and have the highest oil-to-water ratio.

Skin disinfectants include povidone iodine, isopropyl alcohol and chlorhexidine gluconate (CHG). It is difficult to recommend one disinfectant over another as there have not been many head-to-head studies in neonates. Disinfectants containing povidone iodine are rarely used now in preterm infants in the US, due to the risk of thyroid dysfunction.[3]

Chlorhexidine gluconate

CHG is a topical antiseptic used since 1954 which binds to cutaneous and mucosal protein (keratin). It is used for hand washing, skin preparation, vaginal antisepsis, gingivitis, and body washing. CHG is not effective against Clostridium difficile or non-enveloped viruses such as rotavirus, adenovirus, or enterovirus. Around 60% of NICUs in the US use CHG, with some restriction by weight and gestational age. Adverse skin reactions have been reported, but no systemic toxicity. Skin irritation has been seen in preterm infants, even with aqueous CHG. The absorption of CHG is a concern which seems to increase with repeated exposures.[4]

In 2013, the US FDA issued a labelling change for antiseptics containing CHG/isopropyl alcohol, warning that they should be used with caution in premature infants less than 2 months of age, as they may cause irritation or chemical burns. At the same time, case reports of CHG/alcohol skin disinfectants and dressings causing skin injuries are becoming more frequent; therefore, the selection of skin disinfectants for extremely premature infants remains a dilemma for clinicians.

Disinfectant summary

- Remove with water or saline, although CHG may still have lingering effect
- Avoid using isopropyl alcohol-containing disinfectants in ELBW 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

Preventing IV extravasation

Intravenous (IV) extravasation or IV infiltration are the inadvertent leaking of an infusing solution or medication into the surrounding tissue instead of into the intended vascular pathway. IV extravasations are one of the many adverse outcomes in NICU. Recommended prevention methods include ensuring the insertion site is clearly visible, checking the IV site every hour, keeping the IV site out of swaddling blankets, taping at the joint above the insertion site (i.e. on the knee for foot, on the elbow for hand) and avoiding tape or wraps that constrict venous return.

Immediate care of IV extravasations is very important. Consideration should be made to type of extravasated fluid: calcium-containing fluids, antibiotics and vasopressors are all far more caustic than plain fluid (e.g. saline). The degree of injury is also important, i.e. skin discolouration, blistering, or tightness of tissue. Consider using hyaluronidase, multiple puncture techniques, or hydrogel to treat such injuries.

Medical adhesives in NICU

One of the biggest issues in NICU is the removal of medical adhesives which can cause trauma, such as skin stripping and pain. Choose medical adhesives that cause the least tissue trauma while effectively securing medical devices (such as endotracheal tubes, intravascular catheters, and nasogastric tubes) and monitoring equipment, as well as wound dressings. The choices include acrylics, hydrocolloids, polyurethanes, hydrogels, silicone and zinc oxide.

Skincare guidelines take-home messages

- The goal is to protect neonatal skin and promote future skin health
- What we do in the beginning can protect the infant in the future
- Care practices should promote skin barrier integrity

DEVELOPMENT OF SKIN MICROBIOME IN PRETERM INFANTS AND THE PRACTICES THAT IMPACT THIS

In addition to the growing body of evidence about the uniqueness of neonatal skin, recent advances have enabled clinicians to understand the processes involved in colonisation of skin with microorganisms. The term microbiome describes the collective genomes and gene products of the microbes living within and on humans.

As a result of the US National Institutes of Health-sponsored Human Microbiome Project, bacteria are now identified through DNA analysis. Most of these bacteria are healthy or commensal bacteria and some are pathogens. New research suggests that a disease state may not simply be the presence of pathogens but the absence of commensal bacteria.

Diversity of the human skin microbiome early in life

Infant skin has the same diverse phyla of bacteria, represented in different proportions, compared with adult skin.[5] This diversity emerges as early as one month after birth. Infant skin is predominantly Firmicutes whereas adult skin is predominantly Actinobacteria.

It is well known that skin has an innate immunity. There is a symbiotic relationship between skin and skin flora; skin provides sebum (lipids), sweat (minerals), and keratin (protein) to resident flora and in return, the resident flora strengthens the skin's first defense (acid mantle) by producing antibacterials which compete and prevent colonisation with harmful bacteria. Thus, the antimicrobial defense system in the skin is not just a mechanical barrier but plays an active role in fighting pathogenic bacteria. Therefore, it is important not to disturb infants' commensal bacteria as this will increase chances of infection.

The importance of gastrointestinal bacteria

Most of our bacteria is distributed in the gastrointestinal (GI) tract (29%), oral cavity (26%) and skin (21%). Substantial evidence shows that early colonisation of the infant GI tract by microbes is crucial for the overall health of the infant.[6] GI bacteria promotes development of the gut's mucosal immune system, plays an important role in the postnatal development of the systemic immune system, stimulates the production of antibodies to pathogens by the gut-associated lymphoid tissue, aids in reducing an over-reactive immune response (as in autoimmune disease and allergies) and aids in digestion and absorption of foods.

Brain-gut microbiota signaling

The brain and gut communicate with each other, termed 'brain-gut microbiota signaling'. Such signaling works between the brain and gut in two ways. Firstly, from the bottom-up – alterations in gut microbiota affect a variety of social and emotional behaviours. Secondly, from the top-down – stress activates cortisol which leads to increased gut permeability and the crossing of bacteria through the epithelial barrier and a change in the microbiome. This is particularly important in NICU where babies are under continual stress such as pain, being away from their mother, and a high incidence of 'medical care touch' initiated by health care professionals rather than 'therapeutic touch' from parents; it is thought this brain-gut signaling may have a link to necrotising enterocolitis (NEC) and other infections. Furthermore, depression, obesity, autism and anxiety have all been linked to changes in the gut microbiome.[7]

Vaginal vs Caesarean delivery

In the newborn period and in infancy, the skin and gut microbiome are influenced by the mode of delivery.[8] As shown in Figure 3, the microbiome of babies born vaginally matches the mother's vaginal bacteria, whereas the microbiome of babies born by Caesarean section (C-section) match the mother's skin bacteria. During vaginal birth, contact with the mother's vaginal and intestinal flora colonises the skin and gut. During C-section delivery, contact of the newborn's mouth with vaginal and intestinal microbiota is missing: more non-maternally derived bacteria is seen; less diverse flora is seen; there is delayed intestinal colonisation; and the skin surface is dominated by *Staphylococcus aureus*.

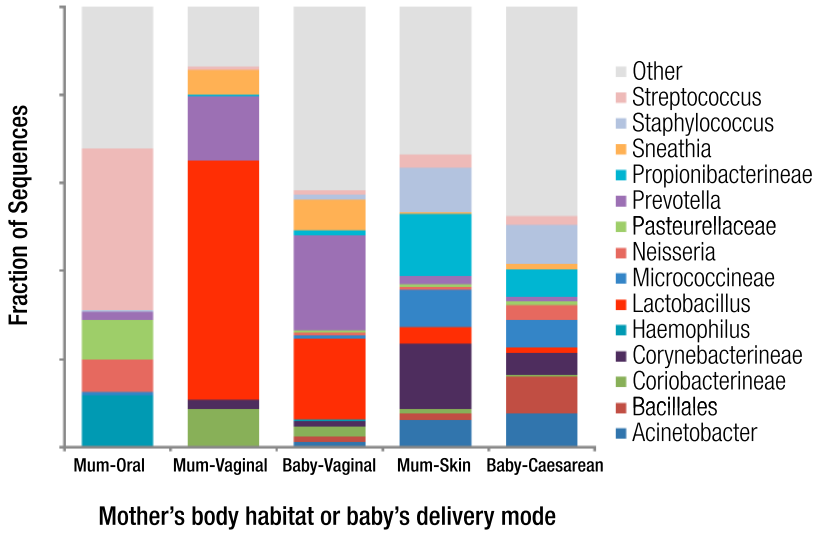


Figure 3. Microbiome transmission from mother to baby at birth correlates with region of first maternal contact[8]

C-Section babies differ

The relevance of the influence of delivery mode on the skin microbiome is not yet clearly understood, but this information may generate a better understanding of how some skin and gut disorders develop. The gut flora in infants may be disturbed for up to 6 months after C-section delivery. Postnatal development of the immune system may also be different if intestinal flora develops differently depending on the mode of delivery. Studies have found that C-section babies had increased rates of obesity, asthma, allergies, type 1 diabetes, eczema, coeliac disease, MRSA infections and gastroenteritis.[9] A link has also been found between C-section delivery, disturbed intestinal colonisation and NEC in premature babies.

Microbiome swab seeding

In babies born by C-section, there is a growing practice of swabbing newborns with healthy bacteria from the mother's vagina. Prior to delivery, the mother inserts vaginal gauze for about an hour. After delivery, the gauze is withdrawn and the baby's mouth and face is swabbed with the mother's bacteria. Babies become colonised by vaginal and intestinal microflora that they would otherwise not have been exposed to.

Term vs preterm birth

The gut microbiome in preterm infants differs from term infants due to immaturity, antibiotic use, and the hospital environment. Preterm infants have an increased colonisation by potentially pathogenic microorganisms, show reduced diversity, and have reduced levels of anaerobes. This imbalance of microbiota has been correlated with NEC and late-onset sepsis.

Influence of antibiotics and breastfeeding

Antibiotic use alters the oral and intestinal microbiota composition. Adult studies show that antibiotics reduce microbial diversity within days and may upset the GI tract for several years. C-section mothers are routinely given antibiotics. Could antibiotics be a factor in the different gut microbiome of the C-section delivered infant? We know that the effect of antibiotics on native gut microbiota is pronounced in infants at 1 year of age. Such infants have an overall reduction in community diversity. Furthermore, faecal samples from NEC patients have microbial analysis distinct from patients without NEC. An increased incidence of NEC may be related to the use of antibiotics in very-low-birthweight infants, as well as C-section infants.

Microbes supported by breastfeeding may provide protection against disorders such as neonatal diarrhoea, allergies, NEC, obesity and type 2 diabetes.

Potential NICU influences

Parental skin, feeding type, environmental surfaces, nursing workspaces, and infant caregiving equipment (e.g. ventilators, incubators), healthcare provider skin and antibiotic use are all associated with changes in infant microbiome.[10] Many studies show skin-to-skin contact in the operating room after C-section is associated with enhanced breastfeeding, less cold stress, decreased crying and longer periods of alertness. However, there are no studies to date on skin-to-skin contact and microbiome transfer in the NICU environment. What needs to be investigated now is how the NICU environment affects the development of the infant's microbiome over time.

Skin microbiome take-home messages

Factors that promote a healthy microbiome in the neonate

- Vaginal delivery
- Term birth
- Skin-to-skin contact after birth
- Breastfeeding
- Avoidance of antibiotics
- Exposure to a variety of microorganisms
- Swab seeding

AN OVERVIEW AND RESEARCH ON INFANT BATHING AND NAPPY RASH

Benefits of vernix

Vernix acts as a foetal protective skin barrier and is unique to humans. It is made up of water (80%), lipids and protein. Production begins at the end of the second trimester, with most accumulated between 36 and 38 weeks gestation. Vernix detaches from skin as levels of pulmonary surfactant rise. It serves a variety of important roles including protection from infection, decreased skin permeability, pH development, skin cleansing and moisturising, and wound healing, so should not be removed during the first bath; it should be allowed to wear off naturally.

Considerations for the first bath

In term babies, the first bath shouldn't be given until the infant's vital signs and temperature have stabilised. However, many hospitals give the baby their first bath based on their unit work flow rather than evidence base. Considerations for the timing of the first bath should also include the stability of the newborn as well as the impact on skin-to-skin time, breastfeeding initiation and early family interaction. Although 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) … should they be?

The AWHONN Guideline[1] recommends waiting 2-4 hours until the first bath, and the World Health Organization (WHO) recommends waiting at least 6 hours. Antiseptic cleaners are not required and it is not necessary to remove vernix.

Studies have shown that skin-to-skin contact between newborns and parents improves mother-infant attachment and increases parental sense of well-being.[11] Furthermore, babies bathed with a fragranced bath product, compared with a non-scented bath product, displayed 30% more engagement cues (mutual gaze, smile, verbalisation) with their parent after bathing[12] and, along with their parent, had reduced stress levels during bathing.[13]

Sponge bathing vs tub bathing

Techniques used include sponge bathing with a small tub such as those provided in the hospital, or a large tub or immersion bathing. Studies have shown that tub or immersion bathing, compared with sponge bathing, maintains temperature, causes less crying and distress for the infant, and does not result in increased infection, even with the umbilical cord in place.[14]

In swaddled bathing, infants are swaddled with a soft blanket or towel before they are immersed in a warm tub of water. Since infants experience random uncontrolled motor movement when placed in a bathtub, swaddling decreases random movements and promotes a secure feeling.

Routine bathing recommendations

- Use mild baby wash
  - Neutral or mildly acid pH
  - Proven to have minimal impact on pH of skin
  - Proven ocular safety
  - Containing a preservative
- Bathe every other day, or less frequently, although this may be influenced by cultural factors
- Avoid rubbing
  - Use rinsing or immersion instead

Myths about baby skin care: water is good

Washing the skin with water alone may not be adequate for cleansing because some of the substances that need to be removed from the surface of the skin are not water soluble, but fat-soluble. The pH of water alone is 7.2, but water hardness and harsh soap raises pH **even more**. Water pH can be lowered to an optimal 5.5 using appropriate cleansers. Water is irritant because of the calcium carbonate content, and hard water has been shown to increase the prevalence of AD. However, water softeners showed no benefit for AD, because water softeners substitute sodium for calcium, which has a slightly higher pH. So the challenge is to lower the pH of water by using a wash product that soaks up calcium, known as a 'chelator'.

Myths about baby skin care: all wash products are bad

Detergents are able to remove impurities without the need for excessive friction. But there are many types of detergent; some have a high pH and can disrupt the skin barrier, such as soaps containing sodium lauryl sulfate, while at the other end of the spectrum are optimal cleansers with a low pH (Figure 4).

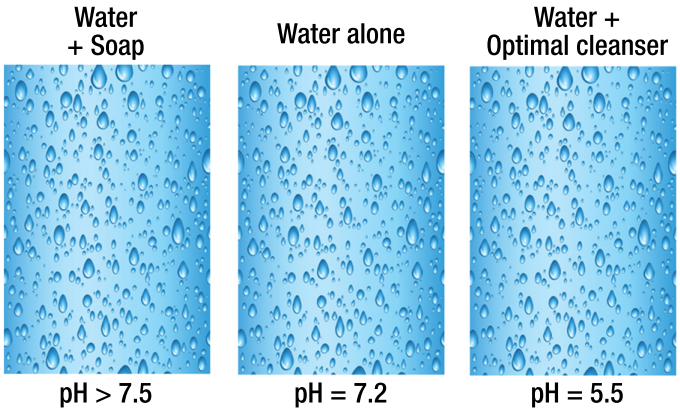


Figure 4. Effect of different types of water on the skin barrier

A UK study compared the effects of ivory soap versus a wash product formulated for newborns (Top To Toe) on skin surface pH. A 2 minute wash in bath water containing ivory soap raised skin pH to 6.8 at 15 minutes and maintained it at around that level for 4 hours. In contrast, Top To Toe wash raised skin pH to about 5.7 at 15 minutes, and maintained it at slightly lower than that level for 4 hours.

Nappy rash

Prolonged contact of skin with urine and faeces is a primary cause of nappy rash. Nappy use also increases skin surface pH and skin wetness, with wet skin known to increase the susceptibility of skin to damage from friction. Risk factors for nappy rash include malabsorption, faecal incontinence, AD, oral antibiotics, and simply wearing nappies.

Skin care practices such as bathing and emollient use can greatly influence the ability of the skin to function as a barrier against environmental stresses such as those causing nappy rash. Frequent nappy changes and use of absorbent nappies helps decrease skin wetness and contact with faecal enzymes, thereby maintaining skin pH. Super absorbent disposable nappies have been associated with a reduced incidence and decreased severity of irritant nappy rash when compared with washable cloth nappies.

Wipes vs water

While wipes containing alcohol are not advisable, not all wipes are bad. Studies have shown that wipes may be a better cleanser than water because they have a lower pH and therefore do not disrupt the baby's acid mantle.

A randomised, controlled trial of 280 full-term infants showed the use of wipes to be similar to the use of cotton wool and water when measuring TEWL, pH, redness, and skin colonisation at 48 hours and 4 weeks.[15] Mothers of infants in the water group reported more nappy rash. A randomised, controlled trial of 130 NICU infants comparing two types of wipes to cloth and water only found improved nappy area skin condition and barrier function when using wipes made from a soft, nonwoven material with water and emollient cleansers.[16]

Nappy rash assessment tool

A guideline for the care of patients wearing nappies developed at a large paediatric hospital provides an assessment tool and treatment recommendations for nappy rash using six categories:

- Intact skin and no erythema
- Intact skin, high risk of breakdown due to causticity of stool, with or without erythema
- Intact skin, erythema and no *Candida*
- Intact skin, erythema, and evidence of *Candida*
- Denuded skin and no *Candida*
- Denuded skin with evidence of *Candida*

The guideline is available in the 2013 AWOHNN *Neonatal Skin Care Evidence-based Clinical Practice Guideline.*[1]

Preventing nappy rash

- Maintain an optimal skin environment in the perineal area
  - change nappies every 1–3 hours during the first month
  - consider using superabsorbent disposable nappies
  - consider nappy holidays
  - some wipes are better than plain water
- Implement strategies to reduce the risk and severity of nappy rash
  - perform skin assessment
  - use petrolatum- or zinc oxide-based ointment
  - avoid rubbing skin barrier product off during cleansing
  - avoid alcohol-containing products
- Treat skin excoriation from nappy rash
  - protect injured skin with thick application of barrier cream
  - consider cholestyramine agents
- Treat nappy rash complicated by *Candida* with barrier cream and antifungal agents
- Talcum powder, topical antibiotics and topical corticosteroids are not recommended

Product selection

An appendix is included in the third edition of the guidelines that can facilitate decision-making or patient discussions about selection of topical skin care products for neonates.

Cleansers

The role of cleansers is to emulsify oil, dirt, and microorganisms on the skin surface so they can be easily removed with water. Ideally, cleansers should not cause skin irritation, not disrupt the normal pH of the skin surface, or cause eye irritation. Select mild cleansers that have a neutral or mildly acidic pH (pH 5.5–7.0) or those that have been shown to have minimal impact on the baby's skin surface pH. Choose cleansers with preservatives that have demonstrated safety and tolerability for newborns. Preservatives are usually needed to prevent the overgrowth of microorganisms that may occur with normal use, but preservatives may result in skin irritation or contact dermatitis.

Fragrances

Fragrances are added to many products for customer appeal. Any ingredient added solely to impart scent should be listed as "fragrance" or "parfum" on the product label. However, what is the difference between fragrance-free and unscented? 'Fragrance-free' means the product has no ingredients added for the sole purpose of imparting scent but can contain fragrance ingredients added for some other purpose. 'Unscented' means the product has been formulated to have no scent but can contain fragrance ingredients added to mask rather than impart scent. Natural fragrances are not always considered to be safer than synthetic fragrances, because some ingredients such as natural essential oils may be allergens or irritants.

Organic, natural and herbal products

There is limited data available about many natural and organic products. Although many herbal therapy products may be safe for adult use, caution is recommended for use in newborns since some of these products have not been tested on neonates. Furthermore, AD has been reported with many herbal therapies including aloe, arnica, bromelain, calendula, chamomile, goldenseal, tea tree oil and yarrow.

Olive oil contains oleic acid which can disrupt skin barrier function. Topical application of olive oil has been shown to compromise the integrity of the adult stratum corneum and induce mild skin irritation.[17] In contrast, the same study showed that sunflower seed oil, which contains linoleic acid, preserved stratum corneum integrity, did not cause irritation, and improved hydration.[17] Of note, some sunflower oils are genetically modified in order to taste like olive oil and as such contain high levels of oleic acid and low levels of linoleic acid.

Bathing and nappy rash take-home messages

- Harsh chemicals can damage the skin barrier
- Some practices affect the local microenvironment potentially shifting microbial composition
- Barrier creams and oils may fortify the skin surface against microbial penetration
- pH changes can affect the bacterial composition of the skin
- Water pH and chemicals are potential skin irritants

OVERALL CONCLUSIONS

Protecting the newborn's delicate skin and promoting an intact and healthy skin barrier is challenging but important in the immediate neonatal period and may also contribute to skin health later in life.

Understanding of the unique differences in neonatal and premature infant skin is necessary to provide daily care such as bathing and applying emollients. Even more challenging is protecting the skin integrity for hospitalised newborns exposed to skin disinfectants, medical adhesives, and devices such as NCPAP, monitors, and IV catheters.

The third edition of AWHONN's *Neonatal Skin Care Evidence-Based Clinical Practice Guideline*[1] presents skin care recommendations based on current, published research in addition to seminal research studies.

Future research about skin care practices – such as bathing and emollient use, the importance of the skin microbiome, and improvements in adhesive technology – is encouraged to expand the body of knowledge and support the commitment to evidence-based practice.

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