

# Children and newborn skin care and prevention \*

## Prevenção e cuidados com a pele da criança e do recém-nascido

Juliana Dumêt Fernandes<sup>1</sup>  
Zilda Najjar Prado de Oliveira<sup>3</sup>

Maria Cecília Rivitti Machado<sup>2</sup>

**Abstract:** Neonatal skin suffers a progressive adaptation to the extrauterine environment and special care is needed during this period. This skin is very sensitive, thin and fragile. Immaturity of the epidermal barrier reduces the defense against the excessive proliferation of microbes and makes the skin more vulnerable to trauma and percutaneous drug toxicity. Because of the peculiar characteristics of newborn, infant and children's skin, the use of cosmetic products designed for hygiene and protection requires caution. In order to preserve the integrity of neonatal and child's skin, this article reviewed basic preventive care practices in relation to hygiene, bathing, cleansing agents, topical products and their percutaneous toxicity.

**Keywords:** Cosmetics; Emollients; Newborn

**Resumo:** A pele do neonato é submetida a um progressivo processo de adaptação ao ambiente extrauterino, para o qual cuidados especiais se tornam necessários. A sua pele caracteriza-se por ser sensível, fina e frágil. A imaturidade da sua barreira epidérmica diminui significativamente a defesa contra a excessiva proliferação microbiana, torna a pele mais susceptível ao trauma e à toxicidade por absorção percutânea de drogas. Devido às características próprias da pele do recém-nascido (RN), de lactentes e de crianças, o uso dos produtos cosméticos destinados à sua higiene e proteção requer um cuidado especial. Com o intuito de preservar a integridade da pele neonatal e infantil, este artigo revisou os cuidados preventivos básicos que se devem ter com a pele dos bebês quanto à higiene, ao banho, ao uso de agentes de limpeza, a produtos tópicos e a sua toxicidade percutânea.

**Palavras-chave:** Cosméticos; Emolientes; Recém-nascido

### INTRODUCTION

The skin is a multifunctional organ of great importance that promotes, through skin barrier function, mechanical protection, thermoregulation, immune surveillance, and prevents the loss of bodily fluids.<sup>1-3</sup> Due to the various terms used in the literature to refer to the skin of the pediatric population, in this review we adopt the following definitions of age range, according to the Ministry of Health, to facilitate the reader's understanding:

**Newborn (NB) or neonate:** from birth to 28 days old.

**Low Birth Weight NB:** newborn weighing less than 2500 grams.

**Premature or preterm NB or:** baby born

before the 37th week of gestation.

**Term NB:** baby whose gestational age is between 37 weeks and 41 weeks and 6 days.

In addition, we used the terms “**nurseling**” or “**babies**” or “**infants**” to refer to babies from 1 to 12 months of age, the term “**child**” to refer to the age range of 12 months to 12 years, the term “**adolescent**” to refer to individuals from 12 to 18 years of age and the term “**adult**” to refer to individuals from 18 to 65 years of age.

It was previously thought that the skin barrier function reached its maturity at about 34 weeks of gestation. However, recent data show that it continues to develop until 12 months after birth.<sup>4</sup> The skin of

Approved by the Editorial Board and accepted for publication on 29.01.2010.

<sup>1</sup> Work conducted at the Clinics Hospital, Faculty of Medicine, University of Sao Paulo (USP) – Sao Paulo (SP), Brazil.

Conflict of interest: None / *Conflito de interesse: Nenhum*

Financial funding: None / *Suporte financeiro: Nenhum*

<sup>1</sup> MD; Collaborating Physician, Department of Dermatology, Clinics Hospital, Faculty of Medicine, University of Sao Paulo (USP) – Sao Paulo (SP), Brazil.

<sup>2</sup> MD; Supervisor, Department of Dermatology, Faculty of Medicine, University of Sao Paulo (USP) – Sao Paulo (SP), Brazil.

<sup>3</sup> MD; Chair, Department of Dermatology, Clinics Hospital, Faculty of Medicine, University of Sao Paulo (USP) – Sao Paulo (SP), Brazil.

©2011 by Anais Brasileiros de Dermatologia

the neonate is subjected to a gradual process of adaptation to the extrauterine environment, and special care becomes necessary during this period.<sup>3</sup> The neonate's skin is characterized by being sensitive, thin and fragile. Moreover, when compared with the skin of term NB, the skin of premature NB is even thinner, with a thinner stratum corneum, reduced cohesion between the epidermis and dermis and a less effective skin barrier function. As a consequence, there is greater transepidermal water loss, increased percutaneous absorption of chemicals and easily-induced skin trauma, even with the removal of any adhesive bandage.<sup>1,5</sup> This leads to tendency to infections, toxicity and difficulties in fluid homeostasis.<sup>5</sup>

The acidic pH of skin surface seen in adults and adolescents (pH <5) has a protective effect against microorganisms.<sup>1</sup> In NB, especially in premature ones, skin surface pH tends to be neutral, which significantly reduces protection against excessive microbial growth. This may also promote increased transepidermal water loss, signaling an alteration of epidermal barrier function.<sup>1</sup>

Epidermal lipids play an important role in maintaining skin barrier function and skin integrity.<sup>6</sup> However, the lipid content of the skin of infants is lower due to the low activity of the sebaceous glands. On the other hand, their skin has a high water content.<sup>7</sup> In nurselings, the hydrolipid film is gradually replaced by nonglandular epidermal lipids, which are less effective in protecting the skin. In addition, the protective lipid barrier may not be reproduced by artificial means, so maximum care is needed not to destroy this barrier. Destruction occurs primarily by the use of inappropriate chemical products.<sup>6</sup>

The dermis of NB and nurselings has less mature collagen than that of adults, and because it contains a high concentration of proteoglycans, it reaches higher water content. Other differences between the skin of NB, nurselings and children compared to that of adults are smaller thickness of the stratum corneum, increased number of vellus hair follicles, lower buffering capacity and higher surface/body volume ratio. The younger the child, the more evident these characteristics are, and they more pronounced in preterm NB, which implies greater susceptibility to potentially harmful external agents, increased transepidermal fluid loss, less ability to maintain homeostasis, and increased percutaneous absorption, which leads to greater systemic toxicity.<sup>8,9</sup> It is, therefore, particularly sensitive to excessive glandular secretion (sweat and sebum), to house dust mites, bacteria present in the external environment, impurities accumulated in the diaper area (feces and

urine), occlusion by diaper material, and extreme weather.

Since the epidermal barrier is immature in infants, skin permeability is very high, especially during the first fortnight of life.<sup>1</sup> This causes a substantial risk of toxicity from the percutaneous absorption of drugs.<sup>10</sup> Moreover, this skin is also more easily attacked mechanically, as in the area of contact with diapers or with the use of wipes, which cause repeated and localized removal of cells of the stratum corneum and, consequently, increase the permeability of the skin.<sup>1,10</sup> Over time, the child's skin becomes more and more impermeable, yet it always remains less permeable than the skin of adults.

The skin care of newborn babies, infants and children should seek to preserve skin integrity, prevent toxicity and to avoid exposure of the skin to harmful chemical agents.<sup>11</sup> Since effective skin barrier function is vital for the newborn and its operation is limited by immaturity, optimized skin care is very important and may minimize the morbidity and mortality associated with this problem in the neonatal period. Moreover, it is necessary to bear in mind the special aspects of the skin of babies and children to prevent and avoid risks related to products applied topically in this age group.

## OBSERVATIONS ON TOPICAL PREPARATIONS

Due to the characteristics of the skin of newborn babies, infants, and children, cosmetic products intended for their hygiene and protection require special attention in their formulation. One of the paramount conditions is that all the ingredients that may be potentially aggressive to the skin be excluded.<sup>12</sup> This condition is obviously extended to all cosmetic products, but certainly more difficult to implement in products for use on the fragile skin of babies and children.

The percutaneous absorption of drugs and topical agents is influenced by the physical and chemical characteristics of the drug and also by the properties of the skin barrier. The higher the body surface area : body weight ratio, the greater the risk of percutaneous toxicity. Other factors involved are immature systems of drug metabolism and, in newborn babies, especially premature infants, immaturity of the epidermal barrier.<sup>13</sup>

Many products designed for use by children have potentially toxic substances which are harmful to the skin of newborn babies. Not even labels containing such phrases as "dermatologically tested" or "balanced pH" or "natural or organic ingredients" guarantee the safety of the ingredients.<sup>6</sup>

Although the skin of the newborn, still immature, is relatively impervious to alcohol, this

substance can cause hemorrhagic necrosis in premature babies when used as a topical antiseptic on occluded skin.<sup>14</sup> Moreover, the alcohol present in cleaning solutions can cause skin burns, mainly in low birthweight NB, so these solutions must be avoided in neonatal units.<sup>3,15</sup>

It is reported that pure clorexedine 0.5% is an effective topical antiseptic agent and is considered a safer alternative, when not associated with alcohol, for use in term NB with no known percutaneous toxicity<sup>15</sup>.

The use of iodine solutions in the skin of the neonate can result in a significant overburden of iodine and a serious and transient hypothyroidism.<sup>3</sup> The exposure of newborn babies to these solutions should be avoided whenever possible. If such exposure occurs, levels of thyroid hormones must be measured, especially in premature babies, whose skin permeability is even higher and the thyroid, immature.<sup>3,16</sup>

Prilocaine, a component of topical anesthetic, can cause methemoglobinemia when it is overdosed. Up to 25mg may be applied to a maximum area of 10cm<sup>2</sup>.<sup>17</sup> Tetracaine gel, another topical anesthetic, does not cause methemoglobinemia, but can cause contact dermatitis in premature babies.<sup>18</sup>

Propylene glycol, an ingredient in many emollients, can cause burning and skin irritation, especially if used at a concentration greater than 5%.<sup>6</sup> Also used as a vehicle of some vitamins taken orally, propylene glycol has been associated with central nervous system toxicity in premature NB.<sup>19,20</sup> In addition, excessive enteral and parenteral use of this substance offers risk of hyperosmolality and seizures.<sup>21</sup>

Other ingredients should also be avoided in newborn babies, infants and children, such as:

- Sodium lauryl sulfate (SLS): It is a potent skin irritant that damages the lipid barrier, causing inflammation and detachment of the skin layers. When combined with other products such as triclosan, it tends to adhere to the skin for hours or days.<sup>6</sup>

- Sodium laureth sulfate (SLES) and ammonium laureth sulfate: They are agents that may produce lather in products such as toothpaste, shower gel, baths foams. They are irritants, may damage proteins and cause oral ulcers.<sup>6</sup>

- Methylisothiazolinone: Found in shampoos and conditioners, it has been associated with neurological defects.<sup>22</sup>

- Parabens (methyl paraben, propyl paraben, ethyl paraben and butylparaben): found in shampoos and lotions for babies and also wipes for cleaning. They can cause contact dermatitis and skin rash.<sup>6</sup>

In the hygiene of babies and children,

products containing perfumes and dyes should also be carefully avoided (due to the risk of contact dermatitis), as well as additives that mimic the scents and colors of fruit and sweets, since they stimulate the ingestion of cosmetics .

Chart 1 shows some harmful effects caused by the transcutaneous absorption of topical products applied to the skin of newborn babies and infants.<sup>3, 12,14 to 18,21</sup>

Other topical preparations should also be used with caution due to the risk of causing harm to newborn babies, infants and children (Table 2).<sup>3,6,18-22</sup>

## CONSIDERATIONS ABOUT VEHICLES

Since any active product needs a vehicle or excipient to keep it in good condition, some considerations about certain types of vehicles must be made, as some of them may also pose risks or harm to the newborn. In addition, certain types of vehicles should be used only in appropriate situations.

**Powders:** they have absorbent, protective, and drying properties and minimize friction. The most frequently used are talc (magnesium silicate), zinc and titanium oxide, clay, kaolin and starch. The use of powders is not recommended in babies, especially talc and starch powder, due to the risk of accidental inhalation, which can lead to irritation, pneumonitis with granuloma formation and pulmonary fibrosis.<sup>23</sup>

**Fat or lipophilic excipients:** they have occlusive properties and can be fluid or oil (sweet almond oil, liquid paraffin), semisolid (lanolin, petroleum jelly) or solid (solid paraffin and waxes). They should not be used in inflammatory and/or exudative dermatoses or skin flexures for their occlusive powder.<sup>24</sup>

**Suspensions:** consist in the combination of liquids and powders. They are indicated for the treatment of exudative and intertriginous dermatoses.<sup>9,25</sup>

**Emulsions:** they are the combination of two non-miscible components - water and oil. According to the dispersed phase, there are two types of systems: water-in-oil (W/O) or oil-in-water (O/A) emulsions, to which a multiplicity of agents are associated, whose composition is not always known and can be irritating to the skin of newborn babies. If the aqueous phase is greater than 45%, O/W emulsions are obtained (such as **creams and lotions**), which are more fluid. If it is less than 45%, the continuous phase becomes oily and we have w/o emulsions (such as **creams or ointments**), which are greasier and more occlusive.<sup>26</sup> When there is the need for the therapeutic use of O/W emulsions in babies and children, these emulsions should be used in acute and exudative dermatitis and in the folds, where occlusion caused by greasier emulsions is not recommended.<sup>27</sup> On the other hand,

**CHART 1:** Risks of transcutaneous absorption of topical products in newborn babies, infants and children

Compound	Toxicity
Aniline (dye used in laundry)	Methemoglobinemia
Pentachlorophenol (laundry disinfectant)	Tachycardia, sweating, hepatomegaly, metabolic acidosis
Hexachlorophene (topical antiseptic)	Vacuolar encephalopathy
Resorcinol (topical antiseptic)	Methemoglobinemia
Boric acid (baby powder)	Vomiting, diarrhea, erythroderma, seizures
Lindane (scabicide)	Neurotoxicity
Salicylic acid	Metabolic acidosis
Isopropyl alcohol under occlusion	Hemorrhagic skin necrosis
Urea (exfoliating, emollient)	Uremia
Povidone-iodine (topical antiseptic)	Hypothyroidism, goiter
Neomycin	Neural deafness
Corticosteroid	Cutaneous atrophy, adrenal suppression
Benzocaine (topical antiseptic)	Methemoglobinemia
Prilocaine (topical anesthetic)	Methemoglobinemia
Methylene blue (dye)	Methemoglobinemia

W/O emulsions, due to their predominantly occlusive power, should be used in babies and children when treatment is necessary, such as in cases of dry skin, xerosis and chronic eczema, because they allow better absorption of the active product.<sup>26, 27</sup>

**EMOLLIENTS**

Emollients are emulsions containing lipids, which soften the skin and restore its elasticity and homeostasis, preventing transepidermal water loss. They leave a lipid film which fills the spaces between the corneocytes, which facilitates their adherence to the stratum corneum. Therefore, they have humectant (draw water into the skin) and occlusive (prevent water from evaporating) properties.<sup>28</sup> Emollients lubricate and moisturize the skin, protect the integrity of the stratum corneum and of the skin barrier, and

treat dry skin.<sup>1, 29-31</sup>

The skin of premature NB has a very little effective epidermal barrier. The daily prophylactic application of emollients to the skin of premature infants is still controversial. It is known that emollients decrease the frequency of dermatitis, prevent dryness and fissures, reduce transepidermal water loss and improve skin integrity. In addition, some believe<sup>1,32,37</sup> that the topical use of certain types of emollients ( for example, Aquaphor™) is beneficial for the water-electrolyte balance in very premature babies.<sup>38</sup> However, other authors have demonstrated that the prophylactic application of emollients in preterm NB may increase the risk of nosocomial infections and coagulase-negative staphylococci infections; therefore, they do not recommend routine prophylactic use of emollients in premature infants.

**CHART 2:** Risks of using topical preparations in newborn babies, infants and children

Compound	Product	Risk
Triclosan	Soap, deodorants, antiseptics	Same risk of toxicity of other phenolic compounds
Propylene glycol	Emollients, cleaning agents	Skin irritation and burning
		Excessive enteral and parenteral use: risk of hyperosmolality and seizures.
Benzethonium chloride	Cleaning Agents	Poisoning by ingestion, carcinogenesis
Glycerin	Emollients, cleaning agents	Hyperosmolality and seizures
Ammonium lactate	Exfoliating, emollient	Possible lactic acidosis
Coal tar	Shampoos, keratolytic products	Cancer risk due to excessive use of aromatic hydrocarbons
Tetracaine	Topical anesthetic	Contact Dermatitis
Ethanol	Oral cleaning solutions	Oral carcinogenesis
Methylisothiazolinone	Shampoos	Neurological defects
Sodium lauryl sulfate	Soap, shampoos	Skin irritation / contact dermatitis
Sodium laureth sulfate	Toothpaste, soap, shower gel, bath foam	Skin irritation / contact dermatitis

<sup>3,32</sup> Other studies have shown that certain types of emollients (such as sunflower oil) may protect the skin from these infections rather than increase their risk. <sup>39-41</sup> Another study found no difference in the rate of nosocomial infection among preterm babies who used and did not use a prophylactic emollient for 4 weeks. <sup>33</sup> A recent study in Bangladesh showed an improvement in the survival rates of high-risk premature NB who used emollients that improved the epidermal barrier. <sup>42</sup> Discrepancies in the results can probably be explained by regional differences and different topical treatments and types of care used. In sum, what is known is that if the use of emollients is needed for the treatment of dry skin in NB babies, emollients that do not irritate the skin of the neonate and that contain a physiological balance of epidermal lipids that enhance the function of the epidermal barrier (cholesterol, ceramide, linolate, palmitate) <sup>43</sup> or those that contain sunflower oil should be used. <sup>44,45</sup> Some studies have shown that sunflower oil is superior to olive, mustard and soybean oil, both in relation to the speed of recovery of the skin barrier and in relation to toxicity and potential of developing contact dermatitis. <sup>39,45-50</sup>

Emollients are recommended in the daily care of dry skin, scaly dermatoses and atopic patients. <sup>9,51</sup> The effectiveness of any emollient increases when it is applied immediately after bathing or to damp skin. Fragrant emollients should be used very carefully due to the risk of irritation and sensitization. <sup>1,6,9,12</sup> When emollients are in the form of **ointment**, they are occlusive and promote a lubricating effect. However, they may cause acne, folliculitis, prickly heat, and also aggravate pruritus (especially in atopic patients) when used in extremely hot and humid areas. <sup>9</sup> When in the form of **cream and lotion**, they are easier to spread, leading to better treatment adherence. They also promote a humectant effect. <sup>9</sup> However, we cannot forget that most emollients also contain inactive ingredients such as preservatives, dyes and perfumes that can often cause skin irritation and allergic contact dermatitis, especially in newborn babies, infants and children at risk. <sup>1,9</sup>

In infants and children with xerosis or those who are atopic, depending on the intensity of skin dryness, emollient ointments or creams, free of perfumes, dyes, and preservatives, are the most effective, safe, and often less expensive. <sup>1,6,9,12,51</sup>

## BATHING

Immediately after birth, the vernix caseosa is often cleaned with a towel. However, the right time for the first bath of the newborn is still controversial. Generally, routine bathing is not considered harmful to the newborn; however, according to World Health

Organization (WHO), it is recommended that the first bath be given only six hours after birth due to the risk of hypothermia during and after bathing. <sup>29,52-57</sup> Nonetheless, a study by Behring *et al.* <sup>58</sup> (2003) showed that there was no significant difference in temperature between infants who were given the first bath one hour after birth and those who had their first bath from 4 to 6 hours after birth, supporting the findings of previous work conducted by Penny-MacGillivray (1996) and Behnke and Varda (2000), who also found no difference in temperature related to the time of the first bath. <sup>59,60</sup> But some authors <sup>61-63</sup> have established that the first bath should be given only when the temperature of the newborn is stabilized, instead of considering only the number of hours after birth as the ideal time for this.

When bathing the newborn, the caregiver should focus especially on the areas that need more attention, such as face, neck, folds and diaper area. <sup>2,27,64</sup> In relation to routine bathing, it has been demonstrated that the bath itself is better than scrubbing with a sponge or some other cloth. The act of rubbing with a sponge or cloth promotes greater heat loss, increased transepidermal water loss and reduced hydration of the stratum corneum. <sup>65-67</sup> The bath should be short, no longer than 5 minutes, especially if soap is used. <sup>3,68</sup> This will also help prevent skin maceration. <sup>27,69</sup> Frequency of bathing varies greatly between certain regions and countries depending on the culture of each place. <sup>62</sup> In fact, in many places, particularly those with warmer weather, mothers prefer to bathe their babies every day, even if not really necessary. <sup>62</sup> However, it is recommended that baths not be given daily. <sup>11,70</sup> They should be given approximately twice a week until the baby starts to crawl. <sup>11,70</sup> Premature infants should be bathed every 4 days. <sup>71</sup> The water temperature should be close to body temperature (37 - 37.5 °C). <sup>11,62,72</sup> However, some authors recommend a slightly lower temperature, corresponding to the temperature of the skin (34-36 °C). <sup>67</sup> After the bath, if the skin of the newborn and infant shows any sign of dryness or cracking, an appropriate emollient should be applied, which, in addition to treating dry skin, protects the integrity of the stratum corneum and skin barrier. <sup>11,29 to 31,73</sup> Emollients are even more beneficial to babies with a higher risk of developing atopy (positive family history), and in these cases they should be used during and after bathing. <sup>62,74-79</sup> Some authors have reported benefits with the use of emulsifying oils. <sup>80,81</sup> The oils reduce water loss from the stratum corneum and keep skin clear of scales and crusts. <sup>9</sup> However, one should avoid adding olive and mustard oils to the bath due to the risk of contact dermatitis, although existing studies have been conducted only with adults. <sup>62,46-49</sup>

Furthermore, we should be careful with bath oils, as they can turn the bathtub into a slippery and dangerous surface.<sup>51</sup> Further studies about the implications of using these oils in infants are still needed.

### CLEANING AGENTS

Soaps are obtained by the reaction of a base with a mixture of fatty acid esters. Traditional bar soaps have good detergency, emulsifying power and produce enough lather, but they have an irritant action and their alkaline pH can destroy the superficial lipid layer of the skin of the baby, leading to excessive skin dryness.<sup>2,82-84</sup> Therefore, they should be avoided. Glycerine soaps, due to the excessive content of glycerin, which is a potent humectant, can absorb excess water out of the skin, potentially causing more dryness and irritation.<sup>68,85</sup>

*Syndets*, also called synthetic detergents or 'soap without soap', do not have the disadvantages of soap and can be a good choice. They consist of surfactants with a good detergent effect, have neutral or slightly acidic pH, are low-lather substances and cause little irritation. They may be solid or liquid, and although pleasant, they should not be used excessively.<sup>68,85</sup>

Ideal cleaning agents should be liquid, mild, soap free, fragrance free, with neutral or slightly acidic pH; they should not irritate the skin or eyes of the baby nor change the protective acid mantle of the skin surface.<sup>2,11,28,62,67,68,82-84,86</sup> Some studies show that use of these liquid cleaners is better than use of only water in the bath, both in terms of hygiene (fecal matter and urine) and drying of the skin.<sup>82,87-98</sup> An additional protective effect to the skin of the baby and child can be achieved using a liquid cleaning agent containing an emollient.<sup>29,30,82,92,95</sup> Although this is the routine recommendation, studies regarding the use of cleaning agents are still limited. In a recent study, the effects on the development of the skin barrier of newborn babies who were given a bath with water, cleansing gel and topical lotion and of those who had a bath with only water were compared.<sup>98</sup> Adverse effects were not observed on the epidermal barrier in any of the groups. Regarding the appropriate time to introduce cleaning agents into the bath of infants, some studies recommend their use soon after the umbilical cord falls,<sup>67</sup> while others specify a time ranging from 2-4 weeks<sup>2</sup> to 6 weeks after birth.<sup>82</sup> However, this time varies according to the personal preference of each mother.<sup>62</sup>

Regarding shampoos, there is not a standard pediatric formula. They are usually based on amphoteric, nonionic agents. While the hair is short, thin and fragile, it is not necessary to use shampoos. The same product can be used for the body and hair.

<sup>62</sup> This, however, is a matter of choice. When shampoos are used, the same aspects should be considered: they should be gentle, only slightly detergent with a pH close to the tear not to burn and irritate the eyes or skin, and they should not change the roots of the hair or be aggressive to the scalp, which are fragile in infancy.<sup>7,51,62,83,99</sup>

Despite the fact that cleaning wipes are practical and have a pleasant smell, they are not recommended by most authors due to the risk of removing the lipid film of the skin and causing sensitization. It should be noted that they contain soap, and that their continued contact with the skin can damage its barrier, causing contact dermatitis. It would be appropriate to rinse after use. Antiseptic soap and lotions<sup>100,101</sup> should also be avoided.

### OTHER SKIN CARE RECOMMENDATIONS FOR NEWBORN BABIES, INFANTS AND CHILDREN

Some other precautions that should be taken to preserve baby's skin:

- In infants, regular cleaning of the umbilical cord with clorexedine in the first 10 days of life until the cord falls can greatly reduce the risk of infection and the risk of neonatal death.<sup>57,102,103</sup>

- The nails of babies should be kept clean and short to avoid injuries to the skin.<sup>3</sup>

- Diapers should be changed frequently and superabsorbent disposable diapers should be used because they have greater capacity of maintaining the diaper area dry.<sup>104</sup> The hygiene of the diaper area with warm water and cotton without soap is sufficient for the daily cleaning of urine. For stools, mild soap is recommended. The routine use of topical preparations to prevent diaper dermatitis is not necessary for children with normal skin.<sup>100</sup> Additives in these preparations have the potential to cause contact sensitization, irritation and/or percutaneous toxicity.

- The use of adhesive bandages on the skin of babies, particularly preterm ones, should be avoided to the maximum due to the risk of lacerating their skin, which is very thin. If their use is really necessary, very small pieces should be used, and they should be removed carefully.<sup>1</sup> To facilitate removal, an emollient can be used.<sup>1</sup>

### CONCLUSION

The skin of newborn babies undergoes a gradual process of adaptation to the extrauterine environment during which special care is necessary. Their<sup>3</sup> skin is sensitive, thin and fragile, with neutral pH on the surface, which significantly reduces the protection against excessive bacterial growth. Its lipid content is lower, but it has a higher water content. It is soft, since the stratum corneum is thinner, and the

epidermis and dermis are thinner than those of adults. Immaturity of the epidermal barrier more frequently leads to dry skin, significantly reduces the protection against excessive microbial proliferation, and makes the skin more susceptible to injury and toxicity by percutaneous absorption of drugs.

Due to the characteristics of the skin of newborn babies and children, cosmetic products intended for their care and protection require special attention in the formulation. Many products designed for use by babies and children have potentially toxic substances that are harmful to their skin. An essential condition is that all the ingredients that may be potentially aggressive to the skin be excluded. This is obviously true to all cosmetic products, but it is certainly more difficult to implement in products for use on the fragile skin of babies and children.

Since effective skin barrier function is vital for the newborn and its operation is limited by the immaturity of this period, optimal skin care is very important and may minimize the morbidity and mortality associated with this problem in the neonatal period. In order to preserve skin integrity and reduce the risks caused by improper care of the skin of newborn babies, infants and children, this article reviewed the key recommendations in relation to hygiene, bathing, use of cleaning agents, topical products and percutaneous toxicity.

Knowing that the cosmetics market, including products meant for pediatric use, has evolved in recent years becoming quite appealing to excessive consumption, physicians must take on the responsibility to reject consumerist habits and be very cautious in prescribing these products. □

## REFERENCES

1. Lund C, Kuller J, Lane A, Lott JW, Raines DA. Neonatal skin care: the scientific basis for practice. *J Obstet Gynecol Neonatal Nurs.* 1999;28:241-54.
2. Darmstad GL, Dinulov JG. Neonatal skin care. *Ped Clin North Am.* 2000;47:757-82.
3. Afsar FS. Skin care for preterm and term neonates. *Clin Exp Dermatol.* 2009;34:855-8.
4. Nikolovski J, Stamatias G, Kollias N, Wiegand B. Infant skin barrier maturation in the first year of life. *J Am Acad Dermatol.* 2007;56(Suppl. 2): AB153 (Abstract P2400).
5. Shwayder T, Aklund T. Neonatal skin barrier: structure, function and disorders. *Dermatol Ther.* 2005;18:87-103.
6. Trotter S. Neonatal skincare: why change is vital. *RCM Midwives.* 2006;9:134-8.
7. Bello RT. Cuidados de higiene cutânea no recém-nascido e lactente. *Revista Bébê-Saúde.* 2000;3:14-15.
8. Eichenfield LF, Hardaway CA. Neonatal dermatology. *Curr Opin Pediatr.* 1999; 11:471-4.
9. Rocha N, Horta M, Selores M. Terapêutica tópica em dermatologia pediátrica. *Nascer e Crescer.* 2004;13:215-25.
10. Afsar FS. Physiological skin conditions of preterm and term neonates. *Clin Exp Dermatol.* 2010;35:346-50. Epub 2009 Sep 15. Review.
11. Kuller J, Raines DA, Ecklund S, Folsom MS, Lund C, Rothwell DM. Evidence-Based Clinical Practice Guideline. Neonatal Skin Care. Washington, DC: Association of Women's Health, Obstetric and Neonatal Nurses. National Association of Neonatal Nurses, 2001.
12. Groot de AC. The allergens in cosmetics. *Arch Dermatol.* 1988;124:1525-9.
13. Mancini AJ. Skin. *Pediatrics* 2004;113:1114-19.
14. Harpin V, Rutter N. Percutaneous alcohol absorption and skin necrosis in a preterm infant. *Arch Dis Child.* 1982;57:477-9.
15. Mannan K, Chow P, Lissauer T, Godambe S. Mistaken identity of skin cleansing solution leading to extensive chemical burns in an extremely preterm infant. *Acta Paediatr.* 2007;96:1536-7.
16. Khashu M, Chessex P, Chanoine JP. Iodine overload and severe hypothyroidism in a premature neonate. *J Pediatr Surg* 2005;40:E1-4.
17. Shachor-Meyouhas Y, Galbraith R, Shavit I. Application of topical analgesia in triage: a potential for harm. *J Emerg Med.* 2008;35:39-41.
18. Taddio A, Lee CM, Parvez B et al. Contact dermatitis and bradycardia in a preterm infant given tetracaine 4% gel. *Ther Drug Monit.* 2006;28:291-4.
19. Catanzaro J, Smith J. Propylene glycol dermatitis. *J Am Acad Dermatol.* 1991;24:90.
20. MacDonald MG, Getson PR, Glasgow AM, Miller MK, Boeckx RL, Johnson EL. Propylene glycol increased incidence of seizures in low birth weight infants. *Pediatrics.* 1987;79:622.
21. Siegfried EC, Shah PY. Skin care practices in the neonatal nursery: a clinical survey. *J Perinatol.* 1999;19:31-9.
22. Newstarget.com [homepage]. Adams M. (2005) Popular shampoos contain toxic chemicals linked to nerve damage. [cited 2009 Jun 10]. Available from: <http://www.newstarget.com/003210.html>.
23. Mofenson HC, Greensher JD. Baby powder: the hazard. *Pediatrics.* 1981;68:265-6.
24. Noble WC. Microbiology of human skin. In: Rook A, ed. Major problems in dermatology, vol.2, 2nd ed. London: Lloyd-Luke Medical Books, 1981. p.330-1.
25. Malloy MB, Perez Woods RC. Neonatal skin care: prevention of skin breakdown. *Pediatr Nurs.* 1991;17:41-8.
26. Falco OB, Plewig G, Wolff HH, Burgdorf WHC. Topical therapy. In: *Dermatology* 2nd, revised edition. Springer - Verlag Berlin Heidelberg, 2000. p.1719-1746.
27. Pinheiro LA, Pinheiro AE. A pele da criança. A cosmética infantil será um mito? *Acta Paediatr Port;* 2007;38:200-8.
28. Lund C. Newborn skin care. In: Baran R, Maibach HI, eds. *Cosmetic Dermatology* St Louis: C.V. Mosby, 1994:349-57.
29. Bergstrom A, Byaruhanga R, Okong P. The impact of newborn bathing on the prevalence of neonatal hypothermia in Uganda: a randomized, controlled trial. *Acta Paediatr.* 2005;94:1462-1467.
30. Ghadially R, Halkier-Sorensen L, Elias PM. Effects of petrolatum on stratum corneum structure and function. *J Am Acad Dermatol.* 1992;26:387-396.
31. Lane AT, Drost SS. Effects of repeated application of emollient cream to premature neonates' skin. *Pediatrics.* 1993;92:415-9.
32. Conner JM, Soll RF, Edwards WH. Topical ointment for preventing infection in preterm infants. *Cochrane Database Syst Rev.* 2004;1:CD001150.
33. Kiechl-Kohlendorfer U, Berger C, Inzinger R. The Effect of Daily Treatment with an Olive Oil/ Lanolin Emollient on Skin Integrity in Preterm Infants: A Randomized Controlled Trial. *Pediatr Dermatol.* 2008;25:174-8.
34. Nopper AJ, Horii KA, Sookdeo-Drost S, Wang TH, Mancini AJ, Lane AT. Topical ointment therapy benefits premature infants. *J Pediatr.* 1996;128:660-9.
35. Pabst RC, Starr KP, Qaiyumi S, Schwalbe RS, Gewolb IH. The effect of application of aquaphor on skin condition, fluid requirements, and bacterial colonization in very low birth weight infants. *J Perinatol* 1999;19:278-283.
36. Wanakukul S, Praisuwan P, Kesorncam K. Effects of clear topical ointment on transepidermal water loss in jaundiced preterm infants receiving phototherapy. *J Med Assoc Thai.* 2001;84:837-841.
37. Rutter N, Hull D. Reduction of skin water loss in the newborn. I. Effect of applying topical agents. *Arch Dis Child.* 1981;56:669-72.
38. Beeram M, Olvera R, Krauss D, Loughran C, Petty M. Effects of Topical Emollient Therapy on Infants at or Less than 27 Weeks' Gestation. *J Natl Med Assoc.* 2006;98:261-4.
39. Darmstadt GL, Mao-Qiang M, Chi E, Saha SK, Ziboh VA, Black RE, Santosham M, Elias PM. Impact of topical oils on the skin barrier: possible implications for neonatal health in developing countries. *Acta Paediatr.* 2002;91:546-54.
40. Darmstadt GL, Badrawi N, Law PA, Ahmed S, Bashir M, Iskander I, et al. Topically applied sunflower seed oil prevents invasive bacterial infections in preterm infants in Egypt: a randomized, controlled clinical trial. *Pediatr Infect Dis J.* 2004;23:719-25.
41. Darmstadt GL, Saha SK, Ahmed AS, Chowdhury MA, Law PA, Ahmed S, et al. Effect of topical treatment with skin barrier-enhancing emollients on nosocomial infections in preterm infants in Bangladesh: a randomised controlled trial. *Lancet.* 2005;365:1039-45.
42. Darmstadt GL, Saha SK, Ahmed AS, Ahmed S, Chowdhury MA, Law PA, et al. Effect of skin barrier therapy on neonatal mortality rates in preterm infants in Bangladesh: a randomized, controlled, clinical trial. *Pediatrics.* 2008;121:522-9.
43. Mao-Qiang M, Feingold K, Thornfeldt C, Elias P. Optimization of physiological lipid mixtures for barrier repair. *J Invest Dermatol.* 1996;106:1096-1101.
44. Bhutta ZA, Darmstadt GL, Hasan BS, Haws RA. Community-based interventions for improving perinatal and neonatal health outcomes in developing countries: a review of the evidence. *Pediatrics.* 2005;115:519-617.
45. Ahmed AS, Saha SK, Chowdhury MA, Law PA, Black RE, Santosham M, et al. Acceptability of massage with skin barrier-enhancing emollients in young neonates in Bangladesh. *J Health Popul Nutr.* 2007;25:236-40.
46. Kranke B, Komericki P, Aberer W. Olive oil - contact sensitizer or irritant? *Contact Dermatitis.* 1997;36:5-10.
47. Williams JD, Tate BJ. Occupational allergic contact dermatitis from olive oil. *Contact Dermatitis.* 2006;55:251-2.
48. Wong GA, King CM. Occupational allergic contact dermatitis from olive oil in pizza making. *Contact Dermatitis.* 2004;50:102-3.
49. Isaksson M, Bruze M. Occupational allergic contact dermatitis from olive oil in a masseur. *J Am Acad Dermatol.* 1999;41:312-315.
50. Loden M, Buraczewska I, Edlund F. Irritation potential of bath and shower oils before and after use: a double-blind randomized study. *Br J Dermatol.* 2004;150:1142-7.
51. Siegfried E, Nopper AJ, Draelos Z, Bree A, Swords S, Lauer SJ. Principles of treatment in Pediatric Dermatology. In: Schachner LA, Hansen RC. *Pediatric Dermatology.* 3rd ed. Churchill Living Stone. 2003. p.87-114.
52. Bergstrom A, Byaruhanga R, Okong P. Tympanic and rectal thermometry in the diagnosis of neonatal hypothermia in Uganda. *J Neonat Nurs* 2004;10:76-9.
53. Byaruhanga R, Bergstrom A, Okong P. Neonatal hypothermia in Uganda: prevalence and risk factors. *J Trop Pediatr.* 2005;51:212-5.
54. Christensson K, Ransjö-Arvidsson AB, Kakoma C, Lungu F, Parkwah G, Chikamata D, et al. Midwifery care routines and prevention of heat loss in the newborn. A study in Zambia. *J Trop Pediatr.* 1988;34:208-12.
55. Omene JA, Diejomaoh FM, Faal M, Diakparomre MA, Obiaya M. Heat loss in Nigerian newborn infants in the delivery room. *Int J Gynaecol Obstet.* 1979;16:300-2.
56. Johansson RB, Spencer SA, Rolfe P, Malla DS. Effect of postdelivery care on neonatal body temperature. *Acta Paediatr.* 1992;81:859-63.
57. World Health Organization Department of Reproductive Health and Research. *Pregnancy, Childbirth, Postpartum and Newborn Care: A Guide for Essential Practice (Section K10)* 2006. [cited 2009 June 7th]. Available from: [http://www.searo.who.int/LinkFiles/Making\\_Pregnancy\\_Safer\\_PCPNC\\_2006.pdf](http://www.searo.who.int/LinkFiles/Making_Pregnancy_Safer_PCPNC_2006.pdf)
58. Behring A, Vezeau TM, Fink R. Timing of the newborn first bath: a replication. *Neonatal Netw.* 2003;22:39-46.
59. Penny-MacGillivray T. A newborn's first bath: when? *J Obstet Gynecol Neonatal Nurs.* 1996;25:481-487.
60. Varda KE, Behnke RS. The effect of timing of initial bath on newborn's temperature. *J Obstet Gynecol Neonatal Nurs.* 2000;29:27-32.
61. Walker L, Downe S, Gomez L. Skin care in the well term newborn: two systematic reviews. *Birth.* 2005;32:224-8.
62. Blume-Peytavi U, Cork MJ, Faergemann J, Szczapa J, Vanaclocha F, Gelmetti C. Bathing and cleansing in newborns from day 1 to first year of life: recommendations from a European round table meeting. *J Eur Acad Dermatol*



- Venerol. 2009;23:751-9.
63. Christidis I, Zotter H, Rosegger H, Engele H, Kurz R, Kerbl R. Infrared thermography in newborns: the first hour after birth. *Gynakol Geburtshilfliche Rundsch.* 2003;43:31-35.
  64. Mancini AJ. Structure and functions of newborn skin. In Eichenfield LF, Frieden IJ, Esterly NB. *Textbook of Neonatal Dermatology.* Philadelphia: WB Saunders Company. 2001. p.18-32.
  65. Henningson A, Nystrom B, Tunnell R. Bathing or washing babies after birth? *Lancet.* 1981;2:1401-3.
  66. Bryanton J, Walsh D, Barrett M, Gaudet D. Tub bathing versus traditional sponge bathing for the newborn. *J Obstet Gynecol Neonatal Nurs* 2004;33:704-12.
  67. Garcia Bartels N, Mleczko A, Schink T, Proquitte H, Wauer R-R, Blume-Peytavi U. Influence of bathing or washing on skin barrier function in newborns during the first four weeks of life. *Skin Pharmacol Physiol.* 2009;22:248-57.
  68. Gelmetti C. Skin cleansing in children. *J Eur Acad Dermatol Venerol.* 2001;15 Suppl1:12-15.
  69. Oestreicher MI. Detergents, bath preparations and other skin cleansers. *Clin Dermatol.* 1988;6:29-36.
  70. Shoaeib FM, All SA, El-Barrawy MA. Alcohol or traditional methods versus natural drying for newborn's cord care. *J Egypt Public Health Assoc.* 2005;80:169-201.
  71. Quinn D, Newton N, Piecuch R. Effect of less frequent bathing on premature infant skin. *J Obstet Gynecol Neonatal Nurs.* 2005;34:741-6.
  72. Anderson GC, Lane AE, Chang HP. Axillary temperature in transitional newborn infants before and after tub bath. *Appl Nurs Res.* 1995;8:123-128.
  73. Lund CH, Osborne JW, Kuller J, Lane AT, Lott JW, Raines DA. Neonatal skin care: clinical outcomes of the AWHONN/NANN evidence-based clinical practice guideline. Association of Women's Health, Obstetric and Neonatal Nurses and the National Association of Neonatal Nurses. *J Obstet Gynecol Neonatal Nurs.* 2001;30:41-51.
  74. Chang WT, Sun HL, Lue KH, Chou MC. Predictability of early onset atopic dermatitis by cord blood IgE and parental history. *Acta Paediatr Taiwan.* 2005;46:272-277.
  75. Moore MM, Rifas-Shiman SL, Rich-Edwards JW et al. Perinatal predictors of atopic dermatitis occurring in the first six months of life. *Pediatrics.* 2004;113:468-474.
  76. Kurz H, Riedler J. [An increase in allergic diseases in childhood – current hypotheses and possible prevention]. *Wien Med Wochenschr.* 2003;153:50-58.
  77. Sugiyama M, Arakawa H, Ozawa K, Mizuno T, Mochizuki H, Tokuyama K, et al. Early-life risk factors for occurrence of atopic dermatitis during the first year. *Pediatrics.* 2007;119:716-723.
  78. Johnke H, Norberg LA, Vach W, Host A, Andersen KE. Patterns of sensitization in infants and its relation to atopic dermatitis. *Pediatr Allergy Immunol.* 2006;17:591-600.
  79. Tomita C, Tanaka Y, Ishii N, Kawaguchi H, Kimura H, Ichikawa S, et al. Atopic dermatitis and related factors observed at infant physical examination at health centers. *Nippon Koshu Eisei Zasshi.* 1997;44:384-390. [Japanese].
  80. Manjra AI, du Plessis P, Weiss R, Motala CM, Potter PC, Raboobee N, et al. Childhood atopic eczema consensus document. *S Afr Med J.* 2005; 95:435-40.
  81. Abeck D, Werfel S, Brockow K, Ring J. Treatment of atopic eczema in childhood. *Hautarzt.* 1997;48:379-83.
  82. Dizon MV, Galzote C, Estanislao R, Mathew N, Govindarajan R. Opportunities for mild and effective infant cleansing beyond water alone. Poster Presented at the 65th Annual Meeting of the American Academy of Dermatology, Washington, DC, USA. 2-6 February 2007.
  83. Cetta F, Lambert GH, Ros SP. Newborn chemical exposure from over-the-counter skin care products. *Clin Pediatr (Phila).* 1991;30:286-9.
  84. Yosipovitch G, Maayan-Metzger A, Merlob P, Sirota L. Skin barrier properties in different body areas in neonates. *Pediatrics.* 2000;106:105-8.
  85. Gelmetti C. Skin cleansing in childhood. In Gelmetti C. *Pediatric Dermatology – Controversies and Current Concepts.* New York: DM Medical Publishing, 1994. p.1-12.
  86. Loffler H, Happle R. Profile of irritant patch testing with detergents: sodium lauryl sulfate, sodium laureth sulfate and alkyl polyglucoside. *Contact Dermatitis.* 2003;48:26-32.
  87. Hiscock H. The crying baby. *Aust Fam Physician.* 2006;35:680-4.
  88. Galzote C, Dizon MV, Estanislao R, Mathew N. Opportunities for mild and effective infant cleansing beyond water alone. *J Am Acad Dermatol.* 2007;56 Suppl.2: AB158 (Abstract P2420).
  89. Visscher MO, Chatterjee R, Ebel JP, LaRuffa AA, Hoath SB. Biomedical assessment and instrumental evaluation of healthy infant skin. *Pediatr Dermatol.* 2002;19:473-81.
  90. Miyake Y, Yokoyama T, Yura A, Iki M, Shimizu T. Ecological association of water hardness with prevalence of childhood atopic dermatitis in a Japanese urban area. *Environ Res.* 2004;94:33-7.
  91. McNally NJ, Williams HC, Phillips DR, Smallman-Raynor M, Lewis S, Venn A, et al. Atopic eczema and domestic water hardness. *Lancet.* 1998;352:527-31.
  92. Warren R, Ertel KD, Bartolo RG, Levine MJ, Bryant PB, Wong LF. The influence of hard water (calcium) and surfactants on irritant contact dermatitis. *Contact Dermatitis.* 1996;35:337-43.
  93. Atherton D, Mills K. What can be done to keep babies' skin healthy? *RCM Midwives.* 2004;7:288-90.
  94. Atherton D. Maintaining healthy skin in infancy using prevention of irritant napkin dermatitis as a model. *Community Pract.* 2005;78:255-7.
  95. Tyebkhan G. Skin cleansing in neonates and infants – basics of cleansers. *Indian J Pediatr.* 2002;69:767-9.
  96. Kuehl BL, Fyfe KS, Shear NH. Cutaneous cleansers. *Skin Therapy Lett.* 2003;8:1-4.
  97. Byers PH, Ryan PA, Regan MB, Shields A, Carta SG. Effects of incontinence care cleansing regimens on skin integrity. *J Wound Ostomy Continence Nurs.* 1995;22:187-192.
  98. Garcia Bartels N, Prosch F, Proquitte H, Wauer R, Schink T, Blume-Peytavi U. Skin care influences skin barrier in newborns: a clinical study. *Eur J Pediatr Dermatol.* 2008;18:2: Suppl.
  99. Enjolras O. Hygiène quotidienne de l'enfant. *Nouv Dermatol.* 1994;13:404-8.
  100. Fernandes JD, Machado MC, Oliveira ZN. Quadro clínico e tratamento da dermatite da área das fraldas – Parte II. *An. Bras Dermatol.* 2009;84:47-54.
  101. Adam R. Skin care of the diaper area. *Pediatr Dermatol.* 2008;25:427-33.
  102. Mullany LC, Darmstadt GL, Katz J et al. Risk factors for umbilical cord infection among newborns of thern Nepal. *Am J Epidemiol.* 2007;165: 203-11.
  103. Mullany LC, Darmstadt GL, Tielsch JM. Safety and impact of chlorhexidine antiseptics interventions for improving neonatal health in developing countries. *Pediatr Infect Dis J.* 2006;25:665-75.
  104. Orange AP. Management of napkin dermatitis. In: Harper J, Orange A, Prose N, ed. *Textbook of Pediatric Dermatology.* Oxford: Blackwell Sciences, 2000. p.153.

*MAILING ADDRESS / ENDEREÇO PARA CORRESPONDÊNCIA:*

*Juliana Dumêt Fernandes*

*Av. Dr. Enéas de Carvalho Aguiar, 255, 3º andar,*

*sala 3.070 – Cerqueira César*

*05403-000 São Paulo – SP, Brazil*

*Phone.: 11 3069-6000*

*E-mail: jdumet@gmail.com*

How to cite this article/Como citar este artigo: Fernandes JD, Machado MCR, Oliveira ZNP. Children and newborn skin care and prevention. *An Bras Dermatol.* 2011;86(1):102-10.