Clinical Approaches to Skin Cleansing of the Diaper Area: Practice and Challenges

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Abstract: Cleansing and care of the diaper area require special consideration to maintain barrier function of the skin in this area and repair the barrier when it is compromised. Diaper dermatitis occurs commonly; understanding and modification of predisposing factors are imperative for caregivers. In this paper, we review important factors in diaper area care, including skin pH, the local microbiome, irritant and allergic potential of contactants, and application of topical agents.

Diaper dermatitis is among the most common skin conditions in neonates and infants. The buttocks and inguinal skin is subject to the stresses of urine, stool, friction, microbes, and chemicals that can contribute to compromised barrier function, dermatitis, and infection. The goal of washing the diaper area, or any skin surface, is to clean the area without irritating the skin or causing allergic contact dermatitis (1). More specifically, the aims of cleansing the diaper area are to facilitate removal of skin contaminants; restore physiologic skin pH, which is raised by occlusion and influenced by microbes; and aid in barrier repair as necessary. Cleansing practices for the diaper area must take into account the unique environment that the diaper creates, the normal skin flora of the area, irritants and bacteria presented by urine and feces, pH of the skin in the area, composition of cleansing agents, and adjunctive topical preparations that can aid in maintenance of an intact skin barrier or treatment of a compromised barrier. This article will discuss the unique cleansing needs of the diaper area, review common practices, discuss data comparing cleansing practices and skin health, present information on pH and diaper care, and discuss specialized skin care products developed for inguinal skin cleansing.

SPECIAL CONSIDERATIONS IN THE DIAPER AREA

The diaper area presents unique challenges to cleansing. First, the creases and folds of the area provide places for contaminants to evade detection during cleaning and, in a similar manner, areas for cleansing agents to be trapped. The occlusive climate that the flexures, and the diaper itself, create is conducive to maceration and microbial growth. Maceration and the potential for it to occur make it imperative to
consider barrier maintenance or repair in any cleansing regimen. Moreover, microbial growth, particularly *Candida albicans*, can necessitate frequent cleaning and application of topical agents to treat infection, adding another step to the cleansing regimen.

Diaper dermatitis is estimated to occur with a prevalence of 7% to 50%, with age and study methodology influencing variable reporting (2,3). Perianal rash has been reported in 7% to 35% of infants (2,4,5). In a large study in the United Kingdom, an incidence of diaper dermatitis of 25% was reported in the first month of life (6). A study using data from the National Ambulatory Medical Care Survey in the United States found that, during the 7-year period studied, babies had a 1 in 4 likelihood of being diagnosed with diaper dermatitis (7). In a smaller study of 31 infants, the incidence of diaper dermatitis was 100% (8). The desire to minimize diaper dermatitis is a major driver of cleansing practices in the inguinal region.

**MICROBIOME AND PH**

Care of the diaper area requires consideration of colonizing and pathologic agents. Composition of skin flora in the diaper area differs from that of other places on the skin. In a study of infants without diaper rash, *Staphylococcus epidermidis* was the most abundant organism isolated. Streptococcal species, *Escherichia coli*, non-*E. coli* fermenters, and others were seen much less often. *Candida albicans* was rarely isolated from the skin. *Staphylococcus aureus*, known to colonize and complicate atopic dermatitis (9–11), was more commonly cultured in the diaper area from infants with atopic dermatitis than in those with normal skin (12). There was no difference in the flora of infants wearing disposable diapers with cellulose pulp core, disposable diapers with cellulose pulp core containing absorbent gel material, and cloth diapers (12). Knowing the colonizers of normal skin can help direct therapy when cultures are taken from skin with dermatitis. Shifts in composition of the bacterial flora influenced by flora from urine and feces can also be more readily detected as pathologic. The flora from these sources also act as irritants, in addition to their direct action as infectious agents.

Urine and feces are the primary contaminants of the diaper area, both contribute to irritant diaper dermatitis. Multiple factors contribute to the irritant potential of urine and feces. Both can change the pH of the skin. Urine can have acidic or basic pH (4.6–8), and feces typically has a basic pH (6.5–7.5). Skin pH can vary across body sites but is generally 4.5 to 6.0 (13,14). It is approximately 5.5 on the buttocks (13). Mixtures of feces and urine can change skin pH and make it more basic (>6). Proteases and lipases in the feces (15) become more active at high pH (16,17). Proteins and fats in the skin are then more likely to be degraded and cause irritation or dermatitis (18).

In addition, fecal microbiota can contribute to irritant diaper dermatitis. Feces contains numerous bacteria species. In a study of neonates in the first 6 days of life, bifidobacteria and bacteroides were most common, followed by *Enterobacteria*, *eubacteria*, lactobacilli, anaerobic cocci and others (19). The number of species cultured from the feces increased as the day of life increased from 1 to 6 in these infants. *Staphylococci* and *streptococci* were uncommon in the samples in this study (19).

**DIAPER WIPES AND COTTON WOOL AND WATER**

Cleansing agents vary from water to soap to synthetic detergents to impregnated disposable wipes. Classically, caregivers would cleanse the diaper area with cotton wool and water. Many caregivers currently use disposable wipes. In the United States, Russia, and the United Kingdom more than 90% of caregivers use disposable wipes (20) and in France, 83% of caregivers use them (20), making wipes the most common means of cleansing the diaper area in these countries. Other cleansing tools used by fewer caregivers were cotton wool, washcloth, tissue or toilet paper, water, and soap. These agents are used alone or in combination, including some use of wipes after soap and water wash (20).

Disposable wipes differ from one another in cleansing lotion components (emollients, cleanser, preservative) and structure of the physical wipe (21). Wipes are made with soft, gentle, absorbent cloth substrates. Modern wipes have mild cleansing lotions that are often alcohol and fragrance free and contain nonionic surfactants. They contain various skin conditioning ingredients, such as dimethicone and glycerin. Preservatives are added to prevent microbial growth. Disposable wipes are convenient and widely available.

A broad set of studies has examined the efficacy and tolerability of disposable wipes. Disposable wipes have been shown to clean the diaper area effectively and to be safe in infants with skin barrier disruption such as atopic dermatitis and eczema (22). In a 4-week-use trial in 60 infants (53 completed the study)
with atopic dermatitis, none were intolerant of wipes, and the percentage of infants with erythema of the diaper area decreased at each of 3 time-points after the initial evaluation (23).

Skin hydration was shown to be no different between babies using disposable, alcohol-free wipes and babies cleansed with cotton wool and water over their first month of life (24). The alcohol-free wipes did not affect transepidermal water loss (TEWL), skin pH, erythema, or presence of microbial skin contaminants or irritants differently than cotton wool and water (no statistically significant difference) (24). Use of wipes has also been studied in a neonatal intensive care unit (NICU). One hundred thirty full- and preterm neonates (gestational age 30–51 weeks at enrollment) admitted to a level III NICU were enrolled in a trial comparing cleansing with two types of disposable wipes with cleansing with a rayon and polyester cloth and water (25). Patients participated for a mean of 10.4 days. Perineal erythema and TEWL were lower in both groups using wipes than in the group using cloth and water. The group using wipes with a pH of 4.0 had a trend toward lower skin pH than the group using wipes with pH 5.2 and the group using cloth and water. Thus, acid mantle formation was affected positively in this group. The study did not enroll patients 23 to 29 weeks of gestational age because of medical comorbidities. Overall, both wipes were shown to be safe and beneficial in patients at least 30 weeks of gestational age.

Studies have specifically examined the effect of wipes on diaper rash. In a group of 117 children 6 to 24 months old who used wipes with a water-based, alcohol-free lotion on a nonwoven clothlike substrate or water and a cleansing material (cotton wool balls for most participants) for 2 weeks, there was no statistically significant difference in diaper rash severity or erythema between the groups at the genitals, perianal area, or buttocks (23). There was less diaper rash in the intertriginous areas in the patients using the wipes than in those using the water and cleansing material (23). Disposable wipes are commonly used and have been shown to be tolerable and effective for use in several populations.

Nevertheless, disposable wipes are not free of complications. Preservatives, especially methylisothiazolinone, have been shown to cause significant allergic contact dermatitis in babies (26) and their caregivers (27,28). In addition, the pH of the wipe can affect the pH of an infant’s skin (21,25). Wipes with a lower than physiologic pH can decrease skin pH, and wipes with a pH close to physiologic levels can be neutral (21).

### ADJUNCTIVE TOPICAL AGENTS

There are few studies examining the use of adjunctive topical agents with specific diaper-area care regimens. In clinical practice, several agents are used in conjunction with wipes and different types of diapers. A barrier paste can help prevent and treat diaper dermatitis (29). Generic, preservative-free 20% zinc oxide ointment is safe and effective for this purpose (30). Powders are not typically recommended because of the risk of infant aspiration (31,32). Patients with suspected or proven superficial yeast and fungal infections should be treated with nystatin, miconazole, or other topical antifungal preparations.

### CONCLUSION

The diaper area provides unique challenges for cleansing and care to prevent and treat diaper dermatitis. Caregivers benefit from having multiple tools, especially diaper choices, cleansing agent variety, and topical antifungal preparations, to assist their care of diapered children.

### CONFLICTS OF INTEREST

Lawrence F. Eichenfield has served as a consultant for Procter and Gamble.

### REFERENCES