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Do early skin care practices alter the risk of atopic dermatitis? A case-control study

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Abstract

Background—The rise in atopic dermatitis prevalence seen in industrialized countries in unexplained. Some authors have suggested that the increase in the use of skin care products is partly responsible. There are few studies examining skin care practices commonly used in treatment of children. We hypothesized that the use of moisturizers early in life may alter the risk for developing atopic dermatitis.

Methods—A case-control study utilizing two control groups was performed. Cases were defined as children under six years of age who developed atopic dermatitis. A normal control and a high-risk control group were used for comparison. Parents or caregivers of children were questioned regarding skin care practices used in early life in an attempt to identify practices that increased the risk of developing atopic dermatitis.

Results—The regular use of a moisturizer on the child during the first six months of life was very common in all groups, 76%, 74.7%, and 78% in the atopic, non-atopic, and high-risk groups, respectively. Because of the high rate of moisturizer use in all groups, no significant differences were found between groups. Watery lotions were the most commonly used moisturizer.

Conclusions—Despite published guidelines advising to the contrary, the regular use of moisturizers was common in this population. Although no one specific skin care practice was associated with atopic dermatitis, the frequent use of products potentially detrimental to the skin barrier raises concern.

Keywords

Atopic dermatitis; Skin barrier

BACKGROUND / INTRODUCTION

Recent genetic advances are elucidating the important role the skin barrier plays in atopic dermatitis (AD) development. Defects in the skin barrier gene filaggrin (FLG) have been found to be strongly associated with AD in several European and Asian populations (1,2) and can be found in up to 50% of patients with moderate to severe AD. The relatively low

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attributable risk of FLG mutations in population-based studies suggest that, while FLG mutations are important, other factors are involved in promoting the full expression of the disease (3-5).

The other genetic or environmental influences that may alter the risk for developing AD beyond FLG mutations are beginning to be identified, such as early life allergen exposures and novel single nucleotide polymorphisms (6,7). In addition, several researchers have suggested that infantile skin care, by damaging the skin barrier, may also alter the risk for AD development (8,9). Bathing and cleansing can have a profound negative impact on the skin barrier and thus, theoretically, may promote the development of AD (10,11).

There are very few studies examining the effects of various skin care methods on any aspect of newborn skin health. A systematic review by Walker in 2005 could not identify any previous studies examining the effects of skin care methods in newborns (12). Work by the Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN) reached similar conclusions in their guidelines pertaining to neonatal skin care (13). The National Institute for Health and Clinical Excellence in the United Kingdom could not identify any studies pertaining to bathing or skin care in the newborn when they formulated their educational booklet on postnatal care (14). Studies are greatly needed to help establish recommendations for postnatal skin care for both the general population and for those at risk of AD development.

The aim of the current study was to gather information regarding the skin care practices used in children prior to the development of AD. We further investigated whether specific practices, such as moisturizer use, are associated with an increased risk of developing AD.

STUDY DESIGN

Overview

After institutional review board approval, a case-control study was performed examining the skin care used by parents and guardians on children prior to the onset of AD. There were two control groups. The "normal control" group consisted of participants with no known history of AD or other atopic diseases. The "high-risk control" group consisted of children without a history of AD but who came from a family with a first-degree relative having a history of eczema. High-risk controls were used in this study to identify any possible protective factors that may have been preferentially used by families with an atopic background that may not have been found in a normal control group.

Sample size

We calculated that 75 subjects per group would be needed to detect with 80% power an odds ratio of 2.5 for the primary outcome of regular moisturizer use in the cases compared to the control group. A two-sided significance level of 0.05 was set. We estimated 40% of the control group would be using regular moisturizer, but had no previous data to guide us.

Setting

All cases and controls were recruited from the Oregon Health & Science University Department of Dermatology from the medical dermatology and pediatric dermatology clinics. Subjects were recruited from October 2006 through May 2008.

Participants

Cases were defined as children five years of age or younger who met Hanifin-Rajka criteria for AD (15). Normal controls were defined as children five years and younger without a

history of AD. High-risk controls were defined as either one parent or sibling with a history of AD. Cases and all controls were selected from office visits in the medical and pediatric dermatology clinics based on diagnosis. Control subjects were identified by presenting diagnosis to the clinic. Control subjects were included only if they had the following diagnoses: hemangioma, neoplasm, or congenital nevus. These diagnoses were felt to be the least influential on a parent's bathing or moisturization practices on their child. There was no case matching. Enrollment goals were not met in the high-risk control group due to slow recruitment in this group.

Variables

Parents or caretakers were interviewed after informed consent was provided. All questions referred to the period of time prior to AD development. Moisturizer use prior to AD onset was the primary outcome. The type of moisturizer (ointment, cream, lotion) was not specified for the main questions, but was a secondary variable. Other variables included the frequency of moisturizer use, bathing frequency, and whether soap was used during the bath. Questions were asked using two different time frames, birth to six months, and six months to two years, in an attempt to capture any trends that may occur as the child gets older.

Statistical methods

Chi-squared tests were used for categorical data. ANOVA was used for comparisons of continuous data. Kruskal-Wallis tests were used for count data or where continuous data were not normally distributed.

RESULTS

The mean age of the subjects with AD (AD group) was 3.0 ± 1.3 years of age, with the youngest being 4 months of age and the oldest being 5 years of age. The mean age of the normal control subjects (control group) was 2.6 ± 1.7 years of age, with the youngest being 1 month of age and the oldest being 5 years of age. The mean age of the high risk control group (high-risk control) was 2.7 ± 1.8 years of age, with the youngest being 1 month of age and the oldest being 5 years of age. There was no significant difference between the three groups based on age, 95% confidence interval, $p=0.142$. In the AD group, the average age of AD onset was 7.8 ± 9.9 months of age. Sixty-three percent (63%) of this AD group was rated as having mild disease by the caregivers, 24% moderate, and 13% severe. The subjects enrolled were 57.3% Caucasian, 1.8% African American, 10.7% Asian, 0.4% Mediterranean, 11.1% Hispanic, and 6.2% other races. The subjects' annual family income was split into six categories with 43.6% having more than \$75,000, 13.3% having \$61,000 to \$75,000, 15.6% having \$46,000 to \$60,000, 6.7% having \$31,000 to \$45,000, 5.8% having \$15,000-30,000 and 5.3% having less than \$15,000.

Moisturizer use

For the first six months of life, 76% of the AD group, 74.7% of the nonatopic dermatitis (NAD) group, and 78% of the high-risk for developing AD (ADHR) subjects applied some moisturizer. There was no significant difference between the three groups in regard to the use of moisturizer, 95% confidence interval, $p=0.913$. Of the subjects that used moisturizer, 63.0% of the AD subjects, 61.3% of the NAD control subjects, and 66.0% of the ADHR control subjects used a lotion or cream that came from a pump-style container. A greasy cream moisturizer was used by 7.0% of the AD subjects, 5.3% of the NAD subjects and 8.0% of the ADHR control subjects. A liquid oil was used by 6.0% of the AD subjects, 5.3% of the NAD control subjects and 4.0% of the ADHR control subjects. An ointment was used by 4.0% of NAD control subjects, but not used by any AD subjects or the ADHR subjects. There was no significant difference between the three groups with regard to the type of

moisturizer used, 95% confidence interval, $p=0.562$. Data regarding the skin care practices from six months of age to two years did not significantly differ from the 0- to 6-month time frame. In addition, no significant differences were found between groups during this time frame as well (data not shown). The results for all skin care practices are summarized in Table 1.

Timing of moisturizer application

There was no significant difference between the three groups with regard to when the moisturizer was applied, 95% confidence interval, $p=0.101$ (Table 1). The majority of subjects in all groups applied the moisturizer directly after bathing while the skin was still moist. Data from the 6- to 24-month period did not significantly differ from the 0- to 6-month data and no significant differences were found between groups in the timing of moisturization variables (data not shown).

Bathing and cleansing

During the first six months of life, the mean number of baths per week was 4.2 ± 2.3 for the AD subjects, 4.0 ± 2.4 for the NAD control subjects and 4.0 ± 1.9 for the ADHR subjects. There was no significant difference between the three groups with regard to the number of baths per week, 95% confidence interval, $p=0.813$.

Between 6 months and 24 months, the mean number of baths per week was $5.0 \pm$ for the AD subjects, $4.9 \pm$ for the NAD control subjects and $4.7 \pm$ for the ADHR subjects. There was no significant difference between the three groups with regard to the number of baths per week, 95% confidence interval, $p=0.797$. Soap or cleanser was used during bathing by 90% of AD subjects, 92% of NAD control subjects and 98% of ADHR subjects. There was no significant difference between the three groups with regard to the use of soap/cleanser, 95% confidence interval, $p=0.214$ (Table 2). There were no significant changes in these data in the 6- to 24-month period (data not shown).

Xerosis and ichthyosis

In the 0- to 6-month time frame, xerosis was reported by 55% of the AD subjects, 21.3% of the NAD subjects and 10% of the ADHR subjects. Ichthyosis was reported by 28% of the AD subjects, 1.3% of the NAD subjects and 4% of the ADHR subjects. There was a significant difference between the AD subjects and two other groups with regard to xerosis and ichthyosis, 95% confidence interval, $p<0.0001$ (Table 3).

DISCUSSION

Our study highlights the widespread use of skin care practices in neonates and infants that may be potentially detrimental to the skin barrier. Because of the unanticipated high rate of moisturizer use in all groups, we were unable to determine whether the regular use of a moisturizer altered the risk for AD development. Despite current skin care guidelines that do not recommend regular moisturizer use in neonates, the majority of all caregivers in this population used them on a regular basis, with the vast majority of parents using watery lotions. Parents also bathed and cleansed their infants with soap or cleansers on a frequent basis. Water exposure (for example, via bathing or possibly lotion use) and cleansing with soap both are known to have detrimental effects to the skin barrier (10,11). Skin care practices that harm the skin barrier may potentially promote AD development. Our data reveal the importance of further research on the effect cleansing and moisturizing may have on neonatal skin physiology, given its widespread and routine use.

The role of skin care in promoting or protecting against AD development in childhood represents a major research gap. A systematic review by Walker in 2005 could not identify any previous studies examining the effects of skin care methods in newborns (12). Two studies do suggest that the type of skin care practices used in early life may alter the risk of AD. A study by Sherriff found an association between an increased hygiene score, which included the frequency of washing/wiping hands and faces and bathing practices of young children, and subsequent eczema risk (16). A study from Kenya found a significant protective effect of the use of petrolatum in infancy on the future development of AD, although they did not find that the use of soaps or detergents in infancy increased the risk of AD (17). Recently, Bartels found that skin care regimens can alter skin barrier function in the neonatal period (18). We recently published a report that demonstrated an oil-in-water emollient may protect against AD development in infants at high-risk for AD development (19). While the use of emollients early in life is an appealingly simple strategy for reducing the risk of AD, more research is needed because some emollients and oils may actually worsen skin barrier function (20,21).

In addition to emollient use, cleansing the skin may also influence AD development. Parents in our survey bathed their children approximately four times per week, with the vast majority using some type of cleanser. Cork correlated the rise in prevalence of AD in the United Kingdom with the exponential rise in personal soap and detergent wash products (22). Several authors suggest the excessive bathing and increased use of soap and detergents in the neonatal period initiates AD in susceptible individuals (8,9). Similar to emollients, different types of cleansers may have varying effects on skin barrier function. Synthetic detergents have less of a negative impact on skin barrier function than true soaps (23). Some authors also suggest using cleansers with a slightly acidic pH, similar to the pH of the skin, because cleansers with a high pH may activate serine proteases and break down the skin barrier (24-26).

To date, there are no studies that compare cleansers of varying pH and skin barrier function in humans.

Fragrances and even water exposure itself may lead to irritated skin, making emollients high in water content (i.e., lotions) potentially detrimental. The majority of our families surveyed used a watery lotion on a regular basis. Using a thicker emollient with higher oil content may not always be a better alternative. While most studies have shown that oil-in-water emollients improve skin barrier function (27-29), some formulations may have detrimental effects. Held and colleagues showed a slight increase in irritant response in normal skin after treatment with an oil-in-water emollient, but no negative effect on TEWL was seen (30). Buraczewska and colleagues showed pre-treatment of normal skin with an emollient containing canola oil and urea worsened the skin barrier function after challenge with a skin irritant (20). Darmstadt showed mustard seed oil and olive oil were detrimental to skin barrier recovery; in contrast, sunflower seed oil improved skin barrier function (21).

A limitation of our study is that the survey population was restricted to one medical center in one city in the United States. The results of this study may not represent other patient populations. Infant care practices are likely to be subject to cultural and geographic factors.

CONCLUSION

In summary, the use of moisturizers in the newborn period was common in our population and conflicts with current skin care guidelines published by the American Academy of Pediatrics. Because of the frequent use of emollients in all groups in our study, we could not determine whether the use of emollients altered the risk of AD development. Because

emollients may have varying effects on the skin barrier, their routine use as an AD prevention strategy cannot be recommended at this time. Further data regarding the effects of skin bathing, cleansing, and emollient use in the newborn period are needed.

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Table 1

Prevalence of skin care practices in children who developed atopic dermatitis (AD) compared to non-atopic controls (NAD) and children at high-risk for developing AD (ADHR).

Skin Care Practice Variable	AD n=100	NAD n=75	ADHR n=50	P-value
Any moisturizer used in first 6 months? (%)	76	74.7	78	0.913
Age when moisturizer use started (months)	0.8	1.0	0.8	0.869
Number of times moisturizer applied/week	4.6	4.0	3.8	0.177
What type of moisturizer used?				
None (%)	24.0	24.0	22.0	
Lotion or cream in a pump (%)	63.0	61.3	66.0	
Greasy cream (%)	7.0	5.3	8.0	
Liquid oil (%)	6.0	5.3	4.0	
Ointment (%)	0.0	4.0	0.0	0.562
When was moisturizer applied?				
Right after bathing while skin moist (%)	54.7	50.9	51.3	
After bathing but when skin dry (%)	33.3	28.1	33.3	
Anytime during the day (%)	8.0	1.8	5.1	
Only if skin dry (%)	1.3	8.8	0.0	
On and off (%)	2.7	10.5	10.3	0.101

Table 2

Bathing and cleansing practices of children in the three groups.

Bathing / cleansing	AD	NAD	ADHR	P-value
# of baths/week during first 6 months	4.2	4.0	4.0	0.881
# of baths/week from 6-24 months	5	4.9	4.7	0.797
Percent who used soap or cleanser (%)	90	92	98	0.214

Table 3

Prevalence of ichthyosis and xerosis in children as reported by parents and caregivers in the three groups.

Xerosis/Ichthyosis	AD	NAD	ADHR	P-value
Xerosis (%)	55	21.3	10	<0.0001
Ichthyosis (%)	28	1.3	4	<0.0001