



Pathophysiology and Management of Mild to Moderate Pediatric Atopic Dermatitis **CE**

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ABSTRACT

Atopic dermatitis (AD), or eczema, is a chronic inflammatory skin condition characterized by relapsing pruritic and dry, scaly lesions. AD affects 10% to 20% of children in the United States and significantly affects the quality of life of patients and their families. Primary care providers (PCPs) are often the first point of contact for the management of AD symptoms. As many as 70% of patients with mild to moderate disease can be managed by a PCP, underscoring the need for these providers to understand basic AD pathophysiology and current standards of care. This article will discuss the basic principles of AD diagnosis and management that PCPs need to optimize patient care, including AD pathogenesis, appropriate use of currently available topical therapies, basic skin care practices, and patient/caregiver counseling points. This article is sponsored by Spire Learning and supported by an educational grant from Pfizer Inc. *J Pediatr Health Care.* (2018) 32, S2-S12.

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KEY WORDS

Atopic dermatitis, corticosteroid, eczema, emollient, skin barrier, topical immunomodulatory

OBJECTIVES

1. Summarize the role of skin barrier dysfunction and inflammatory pathways and responses in AD pathogenesis.
2. Identify management strategies for mild to moderate AD based on patient and caregiver preferences, adherence, and concerns.
3. Describe the efficacy and safety of currently available therapies and their potential role in the management of mild to moderate AD.
4. Implement into practice shared decision-making strategies to increase patient and caregiver involvement in AD management.

INTRODUCTION

Atopic dermatitis (AD) is a chronic, relapsing inflammatory skin disease that affects approximately 10% to 20% of American children and typically presents in patients older than 2 years of age (Shaw, Currie, Koudelka, & Simpson, 2011; Siegfried & Hebert, 2015). Children with AD often experience persistent itching, which often interferes with sleep and significantly affects the quality of life of the patient and family (Pustišek, Vurnek Živković, & Šitum, 2016). Primary care providers (PCPs) are usually the first points of contact for most patients with AD, and as many as 70% of patients have mild to moderate disease that can be effectively managed by a PCP (Eichenfield et al., 2015). This article will discuss AD diagnosis and management that PCPs need to optimize patient care, including AD

pathogenesis, appropriate use of currently available topical therapies, basic skin care practices, and patient/caregiver counseling points.

DIAGNOSING AD

A diagnosis of AD is made clinically and is based on a personal or family history of atopy and clinical presentation of a chronic or relapsing pruritic dermatitis exhibiting typical morphology and age-specific patterns (Eichenfield, Tom, Chamlin, et al., 2014; Simpson, Irvine, Eichenfield, & Friedlander, 2016). Patients with acute flares present with erythematous, scaly lesions, and widespread excoriations. Papules and/or spongiotic vesicles are present in more severe cases. Dyspigmentation and lichenification are hallmarks of chronic disease. In darker skin types, the skin may have a grayish-white “ashy” appearance, and erythema may be difficult to see, whereas follicular accentuation, lichenification, and postinflammatory dyspigmentation are more conspicuous (Siegfried & Hebert, 2015).

Although AD can appear anywhere on the body and at any age, it has a characteristic age-distribution pattern that is helpful in confirming the diagnosis. In infants (birth to 12 months of age), lesions are commonly

Patients with acute flares present with erythematous, scaly lesions, and widespread excoriations.

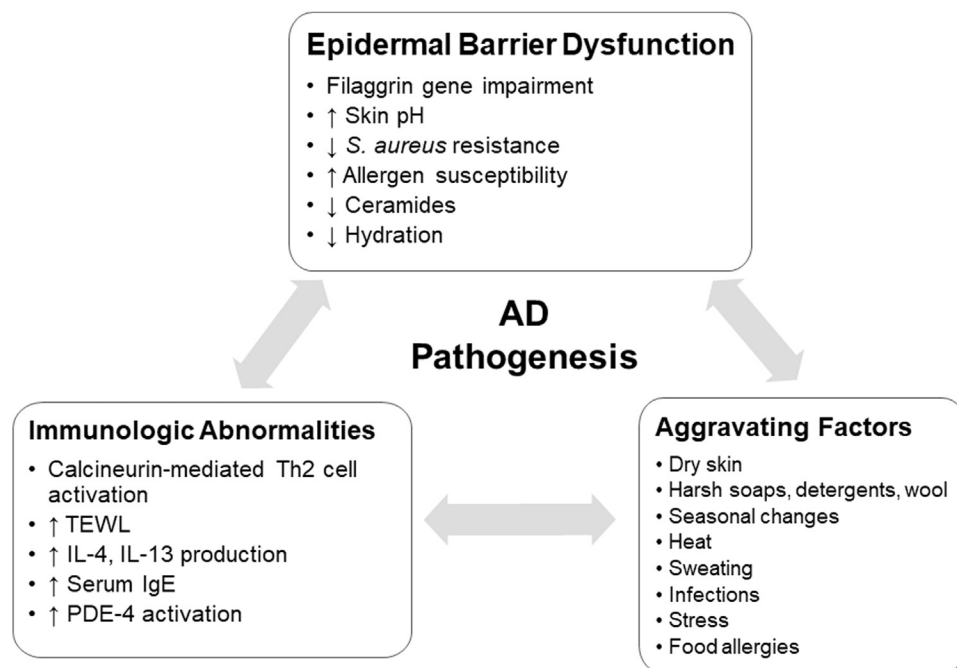
found on the face (except the nose area), upper and lower extremities (including wrists and ankles), and trunk. In toddlers (1–3 years of age), involvement typically includes the face, neck, antecubital and popliteal regions, wrists, and ankles. In older children and adolescents, the face, antecubital and popliteal areas, hands, and feet are more commonly affected (Simpson, Bieber, et al., 2016).

The clinical features of AD are often indistinguishable from other dermatologic conditions that can mimic, overlap, or complicate AD. The most common differential diagnoses to consider are contact dermatitis, psoriasis, scabies, and seborrheic dermatitis (Silverberg & Durán-McKinster, 2017).

PATHOPHYSIOLOGY

Research from the past decade has gleaned evidence of genetic, environmental, and immunologic factors that contribute to the pathogenesis of AD (Figure 1). For instance, a strong family history of atopy, onset of disease before 12 months of age, and mutation of the filaggrin (*FLG*) gene are reliable predictors of disease severity (Eichenfield, Tom, Chamlin, et al., 2014). Environmental factors affecting skin barrier, combined with the patient's genetic profile, aid in predicting risk for developing AD (Simpson, Irvine, et al., 2016; Wen et al., 2009). Exogenous factors such as harsh soaps, detergents, and wool can cause itching and scratching, thereby disrupting the skin barrier and initiating a flare. Endogenous factors contributing to

FIGURE 1. Complex pathophysiology of AD. AD, atopic dermatitis; PDE-4, phosphodiesterase-4; IgE, immunoglobulin E; IL, interleukin; TEWL, transepidermal water loss; Th2, T helper 2.



AD include stress, infections, and food allergies (Morren et al., 1994). Studies from various countries noted an increase in AD in urban areas (Simpson, Irvine, et al., 2016). Factors explaining this trend remain unclear, but it is hypothesized that exposure to microbes in agricultural areas protect the immune system from T helper 2 cell (Th2) overactivity. Additional studies of air pollutants, ozone levels, and ultraviolet radiation exposure have found an association between environmental factors and AD (Kim, 2015; Silverberg, Hanifin, & Simpson, 2013; Simpson, Irvine, 2016).

The *FLG* gene is key in maintaining the protective function of the stratum corneum. Mutation or dysfunction of the *FLG* gene contributes to the development and persistence of AD by increasing skin pH, decreasing resistance to *Staphylococcus aureus*, and causing disorders of keratinization that lead to the atopic triad of AD, allergic rhinitis, and asthma (Leung, Boguniewicz, Howell, Nomura, & Hamid, 2004). Diminished intracellular lipids, particularly ceramides, also contribute to increased permeability and water loss in AD (Egawa & Kabashima, 2016).

Calcineurin-mediated proliferation of Th2 cells down-regulates the expression of *FLG*, resulting in increased transepidermal water loss. Th2 cells produce cytokines, which irritate tissue and increase IgE synthesis, maintaining the inflammatory response (Hanna, Moennich, & Jacob, 2009). Cytokines are central to the pathogenesis of skin inflammation in AD. Interleukin-4 and interleukin-13 are major causes of inflammation and itch in patients with AD. Even in remission,

Th2-specific cytokines show dominance in tissue samples, supporting the hypothesis that underlying chronic inflammation is present even when the skin appears healthy. Overactivity of the enzyme phosphodiesterase-4 (PDE-4) has also been shown to contribute to inflammation in AD (Irvine, Eichenfield, Friedlander, & Simpson, 2016). Topical therapy with a PDE-4 inhibitor dramatically reduced inflammation, thus making PDE-4 a viable therapeutic target for the treatment of AD (Hanifin et al., 1996; Paller et al., 2016).

TREATMENT OF ACUTE FLARES

Topical corticosteroids and immunomodulators (i.e., calcineurin inhibitors and PDE-4 inhibitors) have been shown to be effective at reducing skin inflammation and, to varying degrees, itching associated with AD (Eichenfield, Tom, Berger, et al., 2014; Paller et al., 2016). When prescribing a topical medication, it is important to keep in mind factors that can affect percutaneous absorption. The choice of base, or vehicle, in which the medication is dispersed should be determined by the application site, desired potency, and patient preference. The Table compares the vehicles most commonly used in topical medications. In addition, it is imperative to remember the 500-dalton rule when selecting the most effective topical medication. This rule states that only chemical compounds and drugs with a molecular weight equal to or less than 500 Da can penetrate normal and abnormal skin barriers (Bos & Meinardi, 2000). Other factors, such as humidity, occlusive dressings, and a

TABLE. Comparison of vehicles used in topical medications

	Vehicle	Consistency/appearance	Composition	Recommended application sites	Comment
Relative Potency 	Ointments	Translucent, greasy	Oil base	All, <i>EXCEPT</i> intertriginous areas	Increases potency More lubricating Insoluble in water, difficult to wash off Cosmetically acceptable
	Creams	Smooth, silky	Oil and water mixture	All, including intertriginous areas	Components may cause stinging, burning, or allergy
	Lotions and solutions	Thin, watery, clear	Water and alcohol base	Scalp, hairy areas	Leaves no residue May cause stinging in intertriginous areas
	Gels	Jelly-like	Glycol and water mixture	Scalp, hairy areas	Cooling effect
	Aerosols	Spray	Medication suspended in a base, pressurized	Scalp, moist lesions	Convenient for patients who lack mobility
	Foams	Frothy	High water content	Scalp, hairy areas	Spreads easily, useful for large body surface areas Minimal residue after application
Minimum					

non-intact epidermis can increase percutaneous absorption of a topical medication.

Topical Corticosteroids

Topical corticosteroids (TCSs) are the mainstay of AD treatment for the management of mild to acute flares. Although the advent of newer therapies has allowed a decrease in the length of treatment with TCSs, they remain the first line in treatment (Eichenfield, Tom, Berger, et al., 2014; Eichenfield, Ahluwalia, et al., 2017; Stein & Cifu, 2016). Current guidelines recommend the use of topical corticosteroids in patients with AD who have failed to respond to proper skin care and regular use of emollients alone. Twice-daily application of TCSs for no longer than 2 weeks is generally recommended for the treatment of AD and should be applied only to affected sites because of the risk of local adverse effects, including striae, telangiectasia, generalized hypertrichosis, and skin atrophy. Long-term application of TCSs to the periorbital regions is associated with increased risk for cataracts and glaucoma; therefore, alternative topical therapies (e.g., topical calcineurin inhibitors and PDE-4 inhibitors) should be considered for patients of all ages with periorbital involvement.

Steroid potency, frequency of use, and affected body surface determine the effectiveness of corticosteroids. With a molecular weight of approximately 200 Da, they easily penetrate subcutaneous tissue and the circulatory system. TCSs are ranked according to their potency into groups from strongest (Group I) to weakest (Group VII). Groups IV through VI should be used for infants and for all patients on areas of thinner skin, such as the face and intertriginous areas of the axillae and groin. A list of commonly prescribed TCSs can be found in Figure 2.

Systemic corticosteroid therapy, although effective, results in rapid rebound and worsening of AD when therapy is discontinued. Because the risks of rebounding and the potential adverse effects do not outweigh the benefits, the use of systemic corticosteroid therapy is not recommended.

Topical Calcineurin Inhibitors

The topical calcineurin inhibitors (TCIs) tacrolimus and pimecrolimus are effective nonsteroidal alternatives for the treatment of AD (Carr, 2013; Eichenfield, Tom, Berger, et al., 2014; Stein & Cifu, 2016; Eichenfield, Ahluwalia, et al., 2017). With a molecular weight of approximately 800 Da, TCIs do not penetrate beyond the dermis. These drugs improve skin clearance and itch by inhibiting calcineurin-mediated activation of Th2 cells. Tacrolimus was the first U.S. Food and Drug Administration (FDA)-approved TCI for moderate to severe AD. It is available as an ointment in concentrations of 0.03% for use in patients ages 2 to 15 years and 0.1% for those ages 15 years and older (Valeant

Pharmaceuticals, 2017). Pimecrolimus is available in a cream formulation approved for mild to moderate AD in those ages 2 years and older (LEO Pharma, Inc., 2016). Unlike TCSs, TCIs can be used in all areas of the body, including eyelids, face, and intertriginous areas. Temporary skin burning is the most frequent adverse reaction.

In 2006, the FDA required black box warnings on both TCI labels secondary to a theoretical risk of malignancies, specifically lymphoma (Ring, Möhrenschrager, & Henkel, 2008). Subsequently, two 10-year prospective patient registries were established to track malignancies in patients using TCIs. Protocols required patients to be assessed every 6 months for a period of 10 years for serious adverse events, including systemic and cutaneous malignancies. Data from the first registry is expected to be released in 2017. Before the establishment of the black box warning, clinicians freely, liberally, and successfully used TCIs as a second-line management of AD. A recently published consensus article reviewing literature on TCIs concluded that these

FIGURE 2. Commonly used topical corticosteroids for the treatment of AD. AD, atopic dermatitis; TCSs, topical corticosteroids.

TCSs are ranked according to their potency into groups from strongest (Group I) to weakest (Group VII). Groups IV - VI should be used for infants and for all patients on areas of thinner skin, such as the face and intertriginous areas of the axillae and groin.

Group I

Clobetasol, cream/ointment (0.05%)
Halobetasol, cream/ointment (0.05%)
Diflorasone, cream/ointment (0.05%)
Betamethasone, ointment (0.05%)

Group II

Betamethasone, cream (0.05%)
Halcinonide, cream/ointment (0.1%)
Fluocinonide, cream/ointment (0.05%)
Desoximetasone, gel (0.05%)

Group III

Fluticasone, ointment (0.005%)
Triamcinolone, cream/ointment (0.1%)
Desoximetasone, cream/ointment (0.25%)

Group IV

Fluocinolone, cream/ointment (0.025%)
Prednicarbate, ointment (0.1%)
Clocortolone, cream (0.1%)

Group V

Triamcinolone, cream (0.025%)
Fluticasone, cream (0.05%)
Prednicarbate, cream (0.1%)

products are safe and effective in the treatment of AD and recommended that the black box warning be amended or removed (Friedlander, Simpson, Irvine, & Eichenfield, 2016).

PDE-4 INHIBITORS

In December 2016, crisaborole was approved for treatment of mild to moderate AD in patients 2 years of age and older (Pfizer, 2016). Formulated as a 2% ointment, it has been shown to reduce itching and inflammation and to promote maintenance of the skin barrier. This unique, low-molecular-weight, boron-based PDE-4 inhibitor (251 Da) can pass through the dermis and suppresses proinflammatory cytokines Th1 and Th2, thereby inhibiting tumor necrosis factor- α (Eichenfield, Friedlander, Simpson, & Irvine, 2016; Eichenfield, Call, et al., 2017; Jarnagin et al., 2016). Long-term safety data collected for 1 year after completion of Phase III studies found crisaborole to be well tolerated and safe (Eichenfield et al., 2016; Jarnagin et al., 2016). Temporary application site pain was the most common adverse event (Paller et al., 2016).

Currently, there are clinical trials evaluating the safety and efficacy of other PDE-4 inhibitors for the treatment of AD, including topical formulations of roflumilast and as oral and injectable formulations of apremilast. Roflumilast is a long-acting inhibitor of PDE-4 currently indicated for the treatment of chronic obstructive pulmonary disease. Oral and injectable preparations of apremilast are currently used in the treatment of psoriasis.

TREATING SECONDARY BACTERIAL INFECTIONS

During an acute flare, the skin can become intensely pruritic and erythematous. In some cases, there may be serous exudate present. Therefore, distinguishing between inflammation and secondary infection can be difficult. True impetiginization presents as superficial vesicles or pustules that eventually rupture and form a golden yellow crust. Infection of the deeper layers of the dermis may also be painful to the touch. Oral antibiotics should be used to treat secondary bacterial infections (Eichenfield, Ahluwalia, et al., 2017; Sidbury, Davis, Cohen, et al., 2014); however, to avoid antibiotic resistance, the course should be no longer than 2 weeks. A test culture can be used to differentiate methicillin-resistant *S. aureus* from streptococci and determine the appropriate course of antibiotic treatment. Also, clinicians should consider patient drug allergies when selecting antibiotic therapy.

ANTIHISTAMINES

The use of antihistamines in the treatment of AD is debatable. Current guidelines from the American Academy of Dermatology state that short-term, intermittent use of sedating antihistamines may be beneficial in addressing sleep loss in children due to itch but

should not replace topical therapies in the management of AD (Eichenfield, Tom, Berger, et al., 2014). These include diphenhydramine, hydroxyzine, and cypromethadine. Nonsedating antihistamines, including fexofenadine, cetirizine, and loratadine, are helpful for patients with comorbid allergies but are not recommended to control itching. Topical antihistamines are not recommended for the treatment of pruritus in AD patients because they can be irritating and may cause allergic contact dermatitis. Skin-directed therapies, including frequent moisturization to reduce dryness and use of TCSs to control inflammation, are the most effective methods for controlling itch in AD patients.

PROBIOTICS

The use of probiotics has been explored as a therapeutic option in treating AD (Perry, 2006; Weston, Halbert, Richmond, & Prescott, 2005). Probiotics aid in regulating allergic hypersensitivity reactions and inhibiting the development of IgE antibody production by blocking Th2-mediated immune responses (Rather et al., 2016). However, currently there is not enough evidence to recommend using probiotics for the treatment of AD (Rather et al., 2016). Human breast milk contains a variety of immunologically active substances like immunoglobulins A and G, antimicrobial enzymes, and various leukocytes (of which 90% are neutrophils and macrophages). New studies indicate that human breast milk may provide probiotic organisms (Hassiotou et al., 2013). In a prospective study, 17,046 full-term infants of healthy mothers were followed up for 12 months in Belarus by Kramer et al. (2007). The mothers received assistance with initiating and maintaining breastfeeding to encourage exclusive breastfeeding by the infants. This study found that compared with non-breastfed infants, the occurrence of AD among infants who breastfed was decreased by 46%.

SKIN CARE

Moisturizing

Liberal and frequent application of unscented moisturizers reduces dryness and itching and helps prevent flares. Choice of unscented moisturizer is not as important as ensuring that the patient applies moisturizers at least twice daily. Currently, there is insufficient evidence supporting the use of one type of moisturizer over another (van Zuuren, Fedorowicz, Christensen, Lavrijsen, & Arents, 2017). However, patients and caregivers should be cautioned that skin care products are not subject to approval by the FDA and that claims of efficacy or purity are often unsubstantiated. With the dramatic rise in the use of “natural” and “organic” skin care products, it is also important to caution patients and caregivers about products with natural oils (e.g., coconut oil), because they may be sensitizing in some individuals with AD. Other topical emollients frequently found in skin care products and in topical

vehicles can also cause hypersensitivities in some individuals, including lanolin, propylene glycol, ethylenediamine, and formaldehyde. Clinicians must regularly assess the patient for adverse reactions to moisturizers and topical medications. They must also ensure that the topical therapies they prescribe are free of irritants that may hinder AD improvement. In addition, patients and caregivers should be instructed to read product labels and avoid sensitizing ingredients. When recommending a moisturizer or other skin care product, take care to select a product that is readily available, affordable, and meets the needs of the patient and caregiver.

Bathing Practices

Bathing removes dirt and allergens and sheds skin cells from the body; however, bathing frequency should be suited to the family's needs and preferences. Areas that accumulate debris (i.e., neck folds, axillae, and diaper area) should be cleansed daily. Frequent bathing can irritate and dry out the skin, especially if harsh soaps are used and emollients are not applied immediately afterward. Hot water and prolonged bathing can also dry out the skin, so bath water should be cool or lukewarm, and baths should be limited to 5 to 10 minutes. Because of insufficient evidence, the American Academy of Dermatology does not recommend the addition of oils, emollients, and most other additives to bath water (Eichenfield, Tom, Berger, et al., 2014; Sidbury, Tom, et al., 2014).

Dilute Bleach Baths

Colonization with *S. aureus* is increased in patients with AD and may contribute to true impetiginization, more difficulty with disease control, and triggering of disease flares. Sodium hypochlorite in the bath (or in the form of cleansers used in the shower) may reduce the burden of *S. aureus* and decrease disease severity. To prepare, mix $\frac{1}{8}$ to $\frac{1}{4}$ cup of concentrated bleach in a full bathtub (about 40 gallons) of water. Allow the child to soak for 5 to 10 minutes, then rinse with fresh lukewarm or tepid water and apply moisturizers (and topical medications, if prescribed) to damp skin (Barnes & Greive, 2013; Huang, Abrams, Tloutan, Rademaker, & Paller, 2009).

After-Flare Maintenance Therapy

Proactive maintenance therapies help maintain disease remission. In addition to daily moisturization, once- to twice-weekly application of a TCS or TCI has been shown to be effective in preventing and reducing the frequency of flares (Eichenfield, Tom, Berger, et al., 2014; Stein & Cifu, 2016).

Patient/Caregiver Education

Patient/caregiver education is critical to the success of any AD management plan. Avoid triggers such as excessive bathing without using moisturizers, low-humidity environments, emotional stress, xerosis,

overheating of skin, and exposure to solvents and detergents, especially those with scents. Adherence to prescribed treatment regimens and basic skin care are vital to AD management goal attainment. If topical medicines are prescribed, be sure to instruct the patient/caregiver to apply them first after bathing, followed by moisturizers or emollients. Emphasize the importance of applying unscented moisturizers or emollients at least twice a day. To reduce skin irritation, cotton clothing is recommended. Wet wrap therapy may be useful in reducing disease severity in children with severe or recalcitrant AD. This method involves applying a topical agent (e.g., emollient or TCS) to an affected area and covering it with a damp layer (e.g., tubular bandages, gauze, or a cotton suit), followed by a dry outside layer. Wet wraps occlude the topical agent, resulting in increased penetration. They also provide a physical barrier against scratching. Where appropriate, wet wrap or wet pajama wrap therapy may be recommended 2 to 3 times a week (Eichenfield, Tom, Berger, et al., 2014). For example, if the child only has wrist involvement, a wet wrap therapy may be used. If the whole body is involved, a wet pajama wrap would be appropriate to use. The recommended amount of time to leave the wet wrap on will depend on the patient's skin involvement and the climate where the patient lives.

Patient/caregiver education is critical to the success of any AD management plan.

ADDRESSING QUALITY-OF-LIFE CONCERNS

Patients and caregivers should be evaluated for quality-of-life issues frequently associated with AD, including chronic itching, sleep disturbances, and mental health comorbidities. Children with AD can experience an average of nine flares a year, some lasting over 2 weeks. It has been reported that 87% of AD patients experience daily itching, which supports the hypothesis that underlying inflammation exists even if a rash is not apparent (Zuberbier et al., 2006). Sleep disturbances have been shown to be directly associated with disease severity (Chamlin et al., 2005). In fact, children with moderate disease experience sleep disturbances and frequent waking, which have a negative impact on their mental health and growth rates. Furthermore, it has been reported that up to 30% of children with AD sleep with one or both parents (Chamlin et al., 2005). Although the mechanisms underlying mental health comorbidities in AD are poorly understood, several psychosocial and mental health disorders are associated with AD, including attention deficit hyperactivity disorder, autism, anxiety, and depression (Simpson, Bieber, et al., 2016). If patients

and caregivers are having difficulty coping with the disease or have signs or symptoms of mental health disturbances, PCPs should consider making referrals to psychiatry or psychology specialists for coping and behavior modification strategies.

MAKING DERMATOLOGY REFERRALS

Many AD patients can be managed successfully by PCPs; however, it is important for providers to recognize when to refer AD patients to a dermatology specialist. Referral is appropriate if the patient has refractory AD, if conventional therapies do not provide sufficient improvement, if the patient has AD involving the face or skin folds, or if a comorbidity is present. Until a dermatology appointment is available, it is important to continue treatment and management of AD. When referring patients, it is essential to describe the rash or lesions appropriately. One important factor to keep in mind is that “maculopapulo” rash does not exist in dermatologic terms. If the patient has both macules and papules, then state so.

Many AD patients can be managed successfully by PCPs; however, it is important for providers to recognize when to refer AD patients to a dermatology specialist.

CONCLUSION

PCPs are often the first people patients and caregivers come to for medical management of AD. Most patients with mild to moderate AD can be managed by a PCP. To do so, it is imperative that providers are knowledgeable about AD pathophysiology, basic skin care, and basic treatment/recommendations for mild to moderate disease. Providers should remember that there is always an underlying skin inflammation present in patients with AD and that appropriate treatments and measures of prevention are necessary to effectively manage the disease. Consistent and proper skin care can reduce flare-ups. Patient/caregiver compliance is vital to AD management and treatment goal attainment. When recommending treatments, moisturizers, and/or emollients, providers should consider patient/caregiver factors (e.g., affordability, preference, cultural beliefs/practices). Finally, AD affects not only the patient's quality of life but also that of the entire family. If managing their own AD patients, PCPs need to recognize when to refer to a dermatology specialist.

CASE STUDIES

Case Study 1

A 5-year-old boy presented with a 6-month history of erythematous plaques and fissures on his bilateral feet, dorsal surfaces, and soles, with no interdigital web involvement or maceration (Figure 3). His feet were

very pruritic, and he had been treated with multiple antifungal creams, with intermittent improvement but never full clearing. Initial treatment included cephalexin 250 mg three times per day for 10 days for secondary bacterial infection. The caregiver was instructed to apply prednicarbate emollient cream under moist compresses for 1 hour twice per day. Aquaphor (Beiersdorf Inc., Wilton, CT) was applied after moist compresses were removed. Loratadine 5 mg was given in the morning, and diphenhydramine 12.5 mg was given at bedtime. The patient was asked to return for a follow-up in 1 week.

One-week follow-up

Fissures and scale had resolved with persistent erythema and hyperlinear markings. Pruritis had resolved, and patient was sleeping well at night for the first time in several months, according to the mother. The caregiver was instructed to finish the remaining course of cephalexin. Moist compresses were discontinued, and prednicarbate was decreased to once-daily application for 1 more week. Once-daily application of pimecrolimus was added to the treatment plan, and the caregiver was instructed to moisturize with Aquaphor (Beiersdorf Inc.) or Ceta-phil (Galderma Laboratories, L.P., Fort Worth, TX) twice a day. Loratadine was discontinued; however, diphenhydramine was still given at bedtime. The patient was asked to return in 1 month.

One-month follow-up

The affected areas were completely clear with residual postinflammatory hyperpigmentation, which is expected to resolve over time. Pimecrolimus and diphenhydramine were discontinued. The caregiver received additional counseling about basic skin care and education regarding signs, symptoms, and early home treatment of AD.

Case Study 2

A 17-year-old adolescent presented with a 2-month history of erythematous plaques with scale, fissures, pustules, and excoriations in bilateral antecubital fossae, bilateral arms, bilateral medial thighs, and bilateral ankles to dorsal surfaces of feet. Physical examination showed significant hyperhidrosis on palms and soles (Figure 4). The patient had a past personal history of seasonal allergies, AD, and contact dermatitis to Balsam of Peru, formaldehyde, and glue. Current treatments at the time of the initial visit included Drysol (Person & Covey, Inc., Glendale, CA) to axillae only, fexofenadine 180 mg daily, Vanicream (Pharmaceutical Specialties, Inc., Rochester, MN) to involved areas, and cornstarch to feet. The patient was prescribed cephalexin 500 mg three times per day for 10 days and was instructed to apply fluocinonide cream under cool moist compresses to all affected areas for 1 hour, twice per day, followed by

FIGURE 3. Patient photos for Case Study 1.



Photos courtesy of Peggy Vernon, RN, MA, CPNP, DCNP, FAANP.

Vanicaream (Pharmaceutical Specialties, Inc.) and crisaborole twice per day. He was instructed to continue fexofenadine 180 mg in the morning and hydroxyzine 25 mg at bedtime. He was advised to stop applying cornstarch to the feet, wear only cotton socks, and change them frequently through the day as needed. The patient was asked to return for a follow-up in 1 week.

One-week follow-up

All affected areas were completely clear, with residual postinflammatory hyperpigmentation. Seasonal allergies were controlled with fexofenadine 180 mg. Pruritus resolved, and the patient was sleeping well with hydroxyzine 25 mg at bedtime. The patient was instructed to finish the course of cephalexin, stop fluocinonide, and continue crisaborole twice per day. Fexofenadine was continued, and hydroxyzine was replaced with diphenhydramine 25 to 50 mg at bedtime. He was advised to apply Drysol daily to the axillae, palms, and soles and to continue twice-daily moisturizing with Vanicaream. The patient was asked to return for a follow-up visit in 1 month.

One-month follow-up

All affected areas were completely clear, with no postinflammatory hyperpigmentation. The patient was instructed to discontinue crisaborole and continue fexofenadine and diphenhydramine for seasonal allergies. He was advised to continue applying Drysol (Person & Covey, Inc.) daily to the axillae, palms, and soles and to continue twice-daily moisturizing

with Vanicaream (Pharmaceutical Specialties, Inc.). The patient was provided additional education regarding signs and symptoms of AD and early home treatments.

Case Study 3

A 9-month-old Mixteco male was referred to a pediatric dermatology clinic in Fresno, CA, for severe atopic dermatitis for more than 3 months involving his whole body. At the initial visit, the patient presented with widespread dry erythematous scaly plaques with areas of excoriation and open skin. Topical steroids were prescribed, along with a 2-week course of cephalexin. The parents received instructions for applying the topical medications and education about basic skin care (i.e., bathing and moisturizing). It was also recommended that wet pajama wraps be applied 3 nights per week.

When the patient's condition did not improve much during the first few visits, the parents were asked if they were following the recommended treatment regimen. The patient's mother admitted that they were not using the wet pajama wraps because she was afraid that the child would get pneumonia if he slept in wet clothes during wintertime. As a compromise, the parents were asked to forego the wet wraps during the winter but to resume them during the summer. Also, they were told that if they preferred the child not sleep in wet clothing, they could keep the wet pajama wrap on the patient for about 6 to 8 hours.

FIGURE 4. Patient photos for Case Study 2.



Initial visit



One-week follow-up

One-month follow-up

Photos courtesy of Peggy Vernon, RN, MA, CPNP, DCNP, FAANP.

The parents agreed to apply the wet pajama wraps as indicated; however, the patient's progress continued to be impeded by noncompliance. Instead of getting the prescribed topical medications, the parents would buy over-the-counter topical creams from a local flea market. These medications were manufactured in Mexico and contained a high-potency steroid, antifungal, and antimicrobial. At one point, the patient's skin condition was so critical that he was admitted for toxic epidermal necrolysis and remained in the pediatric intensive care unit for an extended period. When the patient returned to the clinic after his hospitalization, his skin condition had improved dramatically. After receiving additional counseling on the importance of skin care and following treatment regimens to prevent flare-ups, the parents'

compliance improved, and the patient's AD was better controlled.

This case underscores the importance of considering patients' and caregivers' cultural beliefs and other factors that might affect adherence to AD treatment plans. Because we initially neglected to inquire about the parents' cultural practices and beliefs, we were unable to get them to follow the patient's treatment recommendations. As a result, the patient's condition worsened. AD treatments will not work if patients and caregivers do not use them; therefore, it is necessary to address all factors contributing to noncompliance. In this case, we spent a lot of time educating parents about appropriate uses of over-the-counter and prescribed topical therapies. We also stressed the importance of adhering to treatment recommendations to achieve desired patient outcomes.

Clinical Pearls for Treating AD

- Most patients with mild to moderate AD can be managed by a primary care provider.
- AD affects the entire family's quality of life, not just the patient's.
- Underlying skin inflammation is always present—treat with appropriate agents.
- Patient/caregiver adherence is critical to AD management and goal attainment—remember to consider patient and caregiver factors.
- Consistent, proper skin care can reduce symptoms and prevent flare-ups.
- Recognize when to refer patients to a dermatology specialist.
- To prevent delays in treatment, always describe the lesions using proper dermatologic terminology.

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The opinions expressed in this educational activity are those of the faculty and do not represent those of NAPNAP or Spire Learning. This activity is intended as a supplement to existing knowledge, published information, and practice guidelines. Learners should appraise the information presented critically and draw conclusions only after careful consideration of all available scientific information.

This educational activity may contain discussion of published and/or investigational uses of therapies that were not indicated by the FDA at the time of publication, including roflumilast and apremilast. Please refer to the official prescribing information for each product for discussion of approved indications, contraindications, and warnings. Furthermore, participants are encouraged to consult appropriate resources for any product or device mentioned in this activity.

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