A SUPPLEMENT TO

Family Practice News®

Common Dermatologic Problems in the Pediatric Practice

An Overview of Rashes and Lesions

Managing Children With Atopic Dermatitis

Treating Warts and Molluscum in Children

Congenital and Acquired Nevi in the Pediatric Patient

Recognizing and Treating Scabies in Children

Acne Therapy: An Overview

Tinea Capitis and Other Cutaneous Fungal Infections

Protection From Bites, Stings, and Photodamage

Proceedings of a Clinical Roundtable

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Estimated time to complete this educational activity: 1.5 hours.

Target Audience

This activity has been developed for pediatricians, family physicians, and other clinicians who provide health care for children and adolescents.

Educational Needs

As the front-line health care providers for infants, children, and adolescents, pediatric health care providers are continually confronted with a wide variety of dermatologic conditions. Many of these problems, if accurately diagnosed, are quite appropriately managed in the physician’s office. In other cases, recognition of the need for prompt referral to a dermatologic specialist is the more prudent course, with the referring physician working in consultation with a dermatologist colleague. Pediatric specialists must remain up-to-date on the treatment of the most common infections and other dermatologic conditions seen in children.

Learning Objectives

By reading and studying this supplement, participants should be able to:

- Recognize the most common lesions and rashes that are likely to occur in a pediatric population.
- Discuss the approach to diagnosis when the condition is not immediately identifiable.
- Provide a rationale for referral to a dermatologic specialist.
- Summarize the treatment options for each of the diseases or conditions discussed in this supplement.

Faculty and Unapproved Use Disclosures

Faculty/authors must disclose any significant financial interest or relationship with proprietary entities that may have a direct relationship to the subject matter. They must also disclose any discussion of investigational or unlabeled uses of products.

Dr Hebert has received research support from and is a consultant to 3M Pharmaceuticals. Dr Levy has received support from and is a consultant to 3M, Fujisawa Healthcare, Inc., and Novartis Pharmaceuticals Corporation. He discusses the unlabeled uses of imiquimod for molluscum and warts (other than condyloma), and tretinoin for scabies. Dr Orlow discusses the unlabeled uses of tretinoin, adapalene, tazarotene, minocycline, tetracycline, doxycycline, benzoyl peroxide, topical clindamycin or erythromycin, and oral isotretinoin for use below the lowest approved age and/or in use for acne. Dr Paller receives research support from and is a consultant to 3M, Fujisawa, and Novartis. She discusses the unlabeled use of imiquimod for molluscum/warts. She also discusses the unlabeled use of pimecrolimus and tacrolimus for eczema for infants and children under the age of 2 years. Dr Wagner has nothing to disclose.
An Overview of Rashes and Lesions

Rashes come in many shapes and forms. The myriad conditions, diseases, and reactions that can affect the skin to produce these rashes may seem overwhelming to the general practitioner. Dermatologists accrue a body of knowledge over the course of their specialty education and clinical experience, and this article provides a brief summary of some of the most important information that would pertain to the dermatologic problems seen in children. The sheer number of possibilities in the differential diagnoses of rashes and lesions is challenging, but a systematic approach can be helpful in narrowing the list.

Detecting the Etiology of Rashes: Clues on the History and Physical

History can provide useful information in diagnosing the cause of a rash. A list of questions is shown in Table 1, and some clinical pearls that may be helpful for both diagnosis and treatment are provided in Table 2 on page 4. On the skin examination, inspect all parts of the body, not just the area of concern to the patient. Do not neglect the mucous membranes, the genitalia, and the palms of the hands and soles of the feet.

Note the extent of the rash and whether it is symmetric. A symmetric rash distributed equally over the entire body—including extremities—indicates the likelihood of an “inside job,” a systemic reaction. In contrast, a rash that appears only on one part of the body should lead to consideration of an “outside job,” such as contact dermatitis, sunburn, or other nonsystemic cause.

The shape and distribution of a rash also help define its cause. Contact dermatitis is an obvious example: a rash under the umbilicus or watchband suggests nickel dermatitis.

Color is another identifying feature. The majority of rashes seen in the primary care office—perhaps 95%—have an inflammatory component and, therefore, will be red. A rash that is not red is unusual and may require referral to a dermatologist for accurate identification.

Scaly versus Nonscaly Rashes

The next feature to note is whether a red rash is scaly. Scaly rashes involve inflammation in the epidermis, and, if the rash is diffuse, the most common diagnosis is a form of atopic dermatitis (eczema). In general, eczematous eruptions are poorly marginated—that is, there are no areas within the region of the rash where the skin appears normal. It is this feature that helps to distinguish between eczema and lesions of tinea corporis or psoriasis, for example, which are characterized by distinct and discrete red, scaly lesions separated by normal skin.

Nonscaly rashes result from injury to blood vessels in the dermis and usually are accompanied by some swelling. Dermal rashes are familiar to all primary care clinicians. Those seen most frequently are drug rashes and maculopapular eruptions that accompany viruses. Hives—also called urticaria, wheals, or welts—occur as the result of a vascular injury arising from immunologic or nonimmunologic mechanisms. Nonscaly, red dermal rashes may be treated with antihistamines if itching is a problem; cool compresses and emollients also may be applied to the skin for symptomatic relief. Topical corticosteroids are not helpful and should not be used because these are effective only for epidermal inflammation that is clinically apparent as a scale.

A viral exanthem may be clinically indistinguishable from a drug reaction. For this reason, it is important to avoid diagnosing a “drug rash” in a child with a viral infection who is taking a medication. Instead, that child’s chart should indicate that he or she “had a rash while taking…” In addition to symptomatic treatment, it is prudent to stop the drug and choose another medication, in case

Table 1. Questions to Help Diagnose the Cause of a Rash or Lesion

<table>
<thead>
<tr>
<th>Question</th>
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<tbody>
<tr>
<td>1. How long has the rash or lesion been present?</td>
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<tr>
<td>2. Is it changing rapidly (over hours or days)?</td>
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<tr>
<td>3. Do lesions come and go, or persist?</td>
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<tr>
<td>4. Are there any systemic symptoms that appeared at the same time as the rash?</td>
</tr>
<tr>
<td>5. Is the patient taking any medications (including over-the-counter or herbal remedies)?</td>
</tr>
<tr>
<td>6. What are the skin symptoms? (Does the area of the rash itch or burn?)</td>
</tr>
<tr>
<td>7. Does anyone else in the family have this particular rash?</td>
</tr>
</tbody>
</table>

Table 2. Scaly versus Nonscaly Rashes

<table>
<thead>
<tr>
<th>Rashes</th>
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</thead>
<tbody>
<tr>
<td>Scaly rashes</td>
</tr>
<tr>
<td>- Inflammation in the epidermis</td>
</tr>
<tr>
<td>-出现在 the same time as the rash</td>
</tr>
<tr>
<td>- Scaly rashes are characterized by distinct and discrete red, scaly lesions separated by normal skin.</td>
</tr>
<tr>
<td>Nonscaly rashes</td>
</tr>
<tr>
<td>- Injury arising from immunologic or nonimmunologic mechanisms</td>
</tr>
<tr>
<td>- Nonscaly, red dermal rashes may be treated with antihistamines if itching is a problem;</td>
</tr>
<tr>
<td>- Cool compresses and emollients also may be applied to the skin for symptomatic relief.</td>
</tr>
<tr>
<td>- Topical corticosteroids are not helpful and should not be used because these are effective only for epidermal inflammation that is clinically apparent as a scale.</td>
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Amy S. Paller, MD

Annette M. Wagner, MD

Common Dermatologic Problems in the Pediatric Practice
Table 2. Nine Clinical Pearls From a Dermatology Practice

1. Examine the palms, soles, and mucous membranes. A rash limited to the trunk and extremities tends to be less serious than if the palms, soles, and mucous membranes are involved.

2. Too many lesions? It may not be tinea. Nummular eczema involves well-defined, scaly, red lesions that may be mistaken for tinea. The distinguishing feature is number: patients with tinea typically have only between one and five papulosquamous lesions.

3. An annular plaque that looks like tinea is not tinea if there is no scale on the surface. More likely, the diagnosis of such a nonscale plaque is granuloma annulare.

4. Systemic symptoms such as malaise, myalgias, photophobia, or joint swelling with a rash that appears to be eczematous suggest an underlying systemic disease such as lupus or dermatomyositis.

5. Treat itchy rashes with counter-irritants that are refrigerated, such as phenol or menthol lotions. Temperature and a tingling sensation are conducted by the same nerve pathways in skin as itch, so you can't feel itch and tingle at the same time.

6. Eczema is much more common than scabies, but scabies is likely if burrows are evident in the “M” lines in the palms, if lines are seen at the edges of the fingers, if there is scaling between the fingers, and/or if the classic burrow lines appear in the genital region or on the wrists.

7. Milk allergy is rarely a trigger for infantile eczema (<3%). Formula should not be changed for skin symptoms only.

8. Allergic reactions typically produce recognizable patterns. Hives, erythema multiforme, and vasculitis are rash patterns that are recognizable as allergic reactions.

9. Topical steroids do not work on nonscaling eruptions.

The drug actually is the problem. Remember, however, that drug-related eruptions can worsen even when the drug is withdrawn, so continued follow-up is advisable to ensure that the child's condition is improving and not worsening.

More severe injury to the blood vessels can result in an eruption known as erythema multiforme, also commonly seen in general practice. This vascular reaction produces annular, indurated, discrete plaques (with normal skin between plaques) that resemble archery targets. The epidermis in the central portion of the plaques often is necrotic and appears gray or purple. Erythema multiforme lesions with involvement of two or more mucous membranes is a potentially life-threatening systemic reaction that requires immediate referral.

The most serious among the vascular injuries to the skin is vasculitis, a nonscaling, purple rash that does not blanch to the touch. All such eruptions are clinically important and require referral for evaluation of the underlying etiology.

When Is Referral Indicated?

Experienced pediatricians and family practitioners will be able to identify most skin rashes and lesions. Referral is indicated for any patient who has been treated for what appears to be a common skin disease and who is not improving. A dermatologist also should be consulted regarding any unidentified rash in a child who appears ill and/or who has a fever; such a rash is potentially more problematic than an eruption in a child who seems otherwise healthy. The potential for a serious disease is even greater if the extent of the rash is progressing rapidly.

Cautious and prompt management also is required if rashes appear in a very young child—less than 3 months of age—or an immunocompromised patient. In such cases, the rash may be an important clinical sign of a serious underlying problem. In these situations, referral to a dermatologist—or an emergency room, if that seems appropriate—is warranted unless the cause of the rash can be definitively established and the clinical picture is clear.

Erythroderma—confluent erythema over the entire skin surface—has multiple causes, all of which require a dermatologic consultation. In addition, if any portion of a rash is nonblanchable, the underlying etiology must be established, and this usually requires a biopsy.

A localized area of small vesicles or bullae suggests infection with herpes simplex virus, contact dermatitis, or bullous impetigo and does not require a consultation with a dermatologist. Referral is required for rashes accompanied by extensive blisters, bullae, or bruises.

Finally, rashes should not be treated empirically. If a rash is the primary problem and cannot be identified accurately in the primary care office, referral should be made for a diagnosis.

When making a referral to a dermatologist, use the descriptive terminology in Table 3 to document the rash or lesion accurately. The morphology of the rash, its color, shape, and anatomic location should all be documented in referral correspondence.

Conclusion

Careful attention to lesion morphol-ogy, distribution, and color will allow ready identification of the nature of many common rashes. If the etiology of a rash is uncertain—especially in a child who appears ill, an immunocompromised child, or a neonate—prompt referral to a dermatologist is critical.

Table 3. The Language of Rashes and Lesions

<table>
<thead>
<tr>
<th>Bulla</th>
<th>Large, fluid-filled elevation &gt; 1 cm in diameter</th>
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<tbody>
<tr>
<td>Eczematous lesion/eruption</td>
<td>Scaly, red, poorly-defined plaque</td>
</tr>
<tr>
<td>Erosion</td>
<td>Destruction (shallow ulceration) of epidermis</td>
</tr>
<tr>
<td>Hive</td>
<td>Raised, red welt</td>
</tr>
<tr>
<td>Macule</td>
<td>Flat, nonpalpable discoloration &lt; 1 cm in diameter</td>
</tr>
<tr>
<td>Nodule</td>
<td>Dome-shaped, palpable lesion &gt; 1 cm in diameter</td>
</tr>
<tr>
<td>Papule</td>
<td>Palpable lesion &lt; 1 cm in diameter, flat topped or dome-shaped</td>
</tr>
<tr>
<td>Papulosquamous lesion/eruption</td>
<td>Scaly, red, discrete, well-margined plaques</td>
</tr>
<tr>
<td>Patch</td>
<td>Flat, nonpalpable discoloration &gt; 1 cm in diameter</td>
</tr>
<tr>
<td>Plaque</td>
<td>Flat, palpable lesion &gt; 1 cm in diameter</td>
</tr>
<tr>
<td>Ulcer</td>
<td>Erosion of the full thickness of the skin</td>
</tr>
<tr>
<td>Vesicle</td>
<td>A fluid-filled, clear papule</td>
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</table>
Managing Children With Atopic Dermatitis

Amy S. Paller, MD

Atopic dermatitis, commonly known as eczema, is among the most common skin disorders seen in infants and children (Figure 1). At least 85% of children with this condition are affected before 5 years of age, with 60% being affected by 12 months of age. The current prevalence of atopic dermatitis in the pediatric population in the United States is 17.2%, a figure which has tripled in the past several decades. A similar increase has been seen in asthma during this same time.

Although it is not possible to predict the course of atopic dermatitis in individual patients, many children experience clearance of eczema in early childhood—by 3 to 5 years of age—and recent studies have shown that complete clearance occurs in 40% to 60% of patients by the age of puberty or shortly thereafter. Patients whose eczema has not cleared by the time of puberty may still hope to experience improvement over time.

The clinical features and diagnosis of atopic dermatitis are familiar to most pediatricians and family practitioners. This article focuses on treatment, based on what is currently known about the pathology of this disease and the mechanisms of actions of both standard and newer therapies. Treatment includes attention to avoiding trigger factors, moisturization, application of primarily topical antiinflammatory agents, and the use of antistaphylococcal antibiotics when indicated.

Trigger Factors

Common irritants are sweat, saliva, and rough clothing. Patients should minimize exposure to irritants, including sweat, saliva, harsh clothing (particularly wool), harsh soaps and detergents, products with scents (including fabric softeners), and bubble baths. Other allergic triggers specific to an individual child may be difficult to identify, but if they are known, they should be avoided.

Hydration and Moisturization

In addition to being enjoyable for infants and children, daily baths are an effective way of removing surface bacteria and desquamated tissue. To prevent loss of lipids in the skin, baths should be limited to about 10 minutes, and only mild soaps or soapless washes should be used.

To maintain hydration of the skin after bathing, a thick emollient should be applied before water on the skin evaporates—that is, within a few minutes of removing the child from the water. The most effective emollients for decreasing skin dryness are those with the highest content of oil relative to water; thicker and greasier emollients meet this definition.

Enhancing Symptomatic Relief

To decrease pruritus and the sensation of burning at night, topical antiinflammatory agents may be applied. In addition, "wet wraps" applied either after a bath and emolliation or following the application of a topical antiinflammatory can be soothing and promote comfort and sleep. In hospitals, wet gauze bandages are typically used; at home, the same effect can be achieved by dressing a young child in pajamas and socks moistened in plain water (and covered by a dry layer to prevent excess cooling of body temperature).

In general, oral antihistamines are thought to have little direct effect on pruritus, but sedating drugs such as hydroxyzine, diphenhydramine, and doxepin may be helpful in children who have pruritus severe enough to interrupt sleep.

Topical Corticosteroids

Topical corticosteroids have been the mainstay of treatment for atopic dermatitis and are available in a wide range of potencies, from weak (class VII agents, such as hydrocortisone acetate) to ultra-potent (class I). Agents in ointment vehicles offer several advantages over cream or lotion formulations. These include occlusion, more effective penetration, and generally greater efficacy. Corticosteroid ointments are particularly effective in the management of dry, lichenified, or plaque-like areas of dermatitis. The disadvantages of ointments are that they are messier than creams and lotions and are not as well tolerated in warmer temperatures. Oil preparations are most commonly used for scalp dermatitis, although they may be effective on other areas of the body.

Potent corticosteroids are the most effective in managing atopic dermatitis, but they also are associated with the greatest risk for local and systemic side effects. Therefore, a corticosteroid that has the least potency but adequately controls symptoms should be chosen.

The first-line therapy for treating children with exacerbations of eczema—particularly when the disease is mild to moderate—involves blocking the production of inflammatory mediators. No studies have shown that more frequent application increases efficacy.

Concern about the use of corticosteroids in general has led to "steroid phobia" among some families and even some physicians. This fear may cause decreased compliance on the part of caregivers and a reluctance on the part of physicians to prescribe topical corticosteroids at a strength that is adequate to control an eczema flare.

If potent corticosteroids are applied to large body surface areas, used under occlusion, or used chronically, the potential side effects may be local (most commonly, atrophy and telangiectasia) or systemic. However, considering the widespread use of topical corticosteroids, few adverse reactions occur when these agents are carefully chosen and used appropriately, based on the site of application and the severity of the dermatitis.

Once the eczematous flare is controlled, therapy can be tapered to a less potent corticosteroid agent, and/or the patient can be gradually weaned off the corticosteroid and only resume this therapy intermittently, to control future flares.

Calcineurin Inhibitors

Topical calcineurin inhibitors—tacrolimus and pimecrolimus—are alternative agents for treating atopic dermatitis. The mechanism of action of these drugs involves blocking the production of inflammatory mediators—that is, the nuclear transcription of cytokines.

Tacrolimus ointment, 0.03%, and pimecrolimus cream, 1.0%, currently are approved by the US Food and Drug Administration for the treatment of atopic dermatitis in children 2 years of age or older.
age and older. However, studies suggest that these agents are safe in children as young as 3 months of age.\textsuperscript{11} Tacrolimus ointment is often used in children with moderate to severe atopic dermatitis,\textsuperscript{12,13} and pimecrolimus is more commonly used in those with milder eczematous disease.\textsuperscript{13}

These agents have not been associated with the local or systemic side effects seen with corticosteroids, presumably because of the more targeted action of the calcineurin inhibitors. Assays of systemic absorption of tacrolimus and pimecrolimus have shown that, at most, these drugs achieve transient, low blood levels.\textsuperscript{12,13} The lack of demonstrated side effects has led many clinicians to feel confident in using tacrolimus and pimecrolimus on the face (including the periorbital areas) and intertriginous areas.

No increase in cutaneous or systemic infections has been reported with the use of the calcineurin inhibitors.\textsuperscript{13} A burning or stinging sensation may occur during the first several days of application, particularly in children with more severe symptoms. If this reaction does occur, it usually subsides with continued use and the improvement of the dermatitis. To decrease the child’s discomfort, some clinicians mix topical corticosteroids with the calcineurin-inhibiting agent or try to achieve some control of the disease before beginning treatment with either tacrolimus or pimecrolimus alone.

There is no evidence that the use of topical calcineurin inhibitors increases the risk for nonmelanoma skin cancers (NMSCs), but an increase in NMSCs has been reported in organ transplant recipients receiving cyclosporine and oral tacrolimus. Therefore, it is prudent to caution parents and patients about the need for sun protection while using these drugs.

Calcineurin inhibitors may offer a particular advantage over topical corticosteroids in three main areas: (1) when patients have an inadequate response to corticosteroids, (2) when parents or patients have “steroid phobia” despite efforts at education, (3) for the treatment of dermatitis of the head and neck when low-potency corticosteroids fail to control symptoms.

**Antistaphylococcal Antibiotics**

Children with atopic dermatitis also have an increased risk of developing cutaneous *Staphylococcus aureus* infections (Figure 2). Because *S. aureus* overgrowth plays a role in dermatitis, antistaphylococcal antibiotics are important in the management of patients with heavy colonization or infection with *S. aureus*. The most commonly used agents are first-generation cephalosporins, as the resistance of *S. aureus* to erythromycin is increasing. Methicillin-resistant *S. aureus* (MRSA) is not yet a problem for patients with eczema, but community-acquired MRSA is increasing rapidly and chronic antistaphylococcal therapy should be avoided whenever possible. Adding 1/8 to 1/4 cup of chlorine bleach to bath water, if tolerated, can be helpful in reducing the risk of chronic infections.

**Postinflammatory Pigment Changes**

Regardless of the phase of atopic dermatitis postinflammatory hypopigmentation or hyperpigmentation may be seen. Hyperpigmentation often occurs on lichenified skin, particularly in darker-skinned children, because thicker epidermis tends to accumulate epidermal melanin pigment. Pigmentary changes are transient and usually resolve spontaneously when the underlying inflammation is controlled. However, this process may take 6 months or longer, and exposure to sunlight tends to highlight the difference between dyspigmented and uninvolved areas. Parents should be reassured that postinflammatory pigment changes are not scars. Unless secondary infection occurs or lesions are deeply gouged, atopic dermatitis is not a scarring disorder.

**Conclusion**

Parents should be reminded that atopic dermatitis is a chronic disease and that topical immunosuppressive therapy is not a cure. If a child has an active, underlying tendency toward cutaneous inflammation and comes into contact with a trigger, a flare will occur. Control of that flare requires aggressive management with a topical antiinflammatory agent. For some children—particularly those who have moderate to severe atopic dermatitis—maintenance of control may require daily or twice-daily use of a topical immunosuppressive agent. In children with milder disease, control may be achieved by daily hydration and moisturization, with intermittent use of topical corticosteroids to control flares.

The observation that patients with atopic dermatitis have an increased risk for other atopic disorders—particularly asthma and allergic rhinitis—has led to research exploring the possible mechanisms for such a connection. Studies in the mouse model have demonstrated that disruption of the stratum corneum and exposure to allergens early in life can increase the risk for the subsequent development of asthma. These lines of inquiry have resulted in a theory called the “atopic march,” suggesting that patients begin with atopic dermatitis and later have other manifestations of atopy, especially asthma.

Continuing studies are exploring this theory, and seeking to evaluate whether early, aggressive treatment will reduce a child’s risk for the later development of other atopic conditions. Support groups (www.nationaleczema.org) and other sources of information (eg, www.skincarephysicians.comeczemanet) may be helpful to families who must cope with the issues involved in caring for a child with atopic dermatitis.

**References**


Warts represent a usually benign infection of skin and mucous membranes caused by the human papillomavirus (HPV). More than 100 types of HPV have been identified, and relationships exist between the HPV types and the variety of warts that are seen clinically. For example, verruca vulgaris (the common wart) can be seen with HPV types 1, 2, and 4, with type 2 predominating. Verruca plana (flat warts) usually are caused by HPV types 2 and 3. Types 1, 3, and 6 are the most common causes of verruca plantaris (plantar warts). Finally, condylomata acuminata (genital warts) usually are associated with HPV types 6 and 11, although types 16 and 18 also may cause genital warts. Types 16 and 18 are associated with cervical and anogenital carcinoma.

Unless the presentation is unusual, few physicians would fail to recognize these types of warts. When the clinical presentation of verruca vulgaris is atypical, these warts may be confused with molluscum contagiosum, foreign body reactions in the skin, a variety of insect bite reactions, or, in immunocompromised patients, malignancy. Atypical verruca plana occasionally may be confused with either molluscum, a variety of benign adnexal tumors, or with epithidymosplasia verruciformis, another HPV-related infection. Verruca plantaris may be clinically confused with a simple callus, a foreign body reaction, or any of a number of benign tumors. Finally, very occasionally, condylomata acuminata may be confused with the syphilitic lesion, condyloma latum, molluscum, developmental skin tags, a small epidermal nevus, or lymphatic or other vascular malformations.

**Treatment of Warts**

In more than 50% of cases, warts resolve spontaneously. Although the period of resolution is variable, most warts will take about 2 years to resolve without treatment. Multiple treatment options are available, but before undertaking any therapy, clinicians should advise parents honestly that no particular treatment is totally effective, and, in fact, that many remedies can be painful.

Treatments range from observation alone, to tape occlusion, to a variety of destructive or surgical modalities, chemical or cytotoxic treatments, and immunotherapies. No treatment for warts is uniformly effective, and so clinicians should be familiar with the options currently available. These will not be completely addressed, but some comment on certain modalities may be helpful here.

Cryosurgery is a common technique in the dermatologist’s office, but pediatricians and family practitioners should be aware that some cryofreeze units being marketed today do not provide sufficient freezing to eliminate viral tissue. For cryosurgery to be effective, liquid nitrogen must be used and is painful.

Topical cantharidin is an option for children with recalcitrant warts. When using cantharidin on the plantar aspect of the feet, we first pare or curette the surface of the wart. For stubborn lesions, a technique that we have found to be useful in our practice is a combination of modalities, using cantharidin or liquid nitrogen first, followed by the immune response modifier imiquimod, then salicylic acid under occlusion. The “sandwich” should be removed and replaced every 2 to 3 days or once weekly, depending on the age of the patient and the site of the lesion.

Imiquimod alone, under occlusion, may be helpful for flat warts, particularly for smaller lesions. Other agents that may be helpful for flat warts include salicylic acid and retinoids. Regardless of the agent used, effects tend to be enhanced if the keratotic surface is abraded before application of the medication. Occlusion may be accomplished with any occlusive tape, including—but not limited to—duct tape. The major advantage of duct tape is that its adhesive properties are long-lived, even in water.

Immunotherapy also is an option for difficult cases (and is especially helpful for difficult anatomic sites, such as the feet). One method is to sensitize the patient with a 2% solution of squaric acid by placing a small amount on the forearm. In 2 weeks, apply squaric acid, 0.6% - 0.8%, to the surface of the warts. Hydrating and abrading the warts before applying the squaric acid solution enhances the efficacy of this method. An immunologic reaction should occur within 6 to 8 weeks. Mumps and Candida antigen have been studied for their efficacy in clearing warts, but an individual patient’s response to the immunologic challenge must be substantial for a therapeutic benefit to be seen.

**Molluscum Contagiosum**

Molluscum contagiosum (Figure) is a viral infection that involves the skin and mucous membranes. The viral culprit is known by the genus name *Molluscipoxivirus*. The molluscum virus proliferates in the follicular epithelium and replicates within the cytoplasm. As with warts, molluscum are acquired by direct contact with hosts or, in some cases, a variety of fomites: an element of autoinoculation also must be considered. A number of theories persist regarding methods of transmission of both warts and molluscum. One that is plausible concerns traumatized skin as the site of virus infection. This would explain, for example, why molluscum lesions reported in public swimming pool users tend to occur most frequently on the trunk: as children pull themselves up out of the water over the side of a concrete pool, they can abrade the skin, presenting a site of entry for any organisms that are present. Nevertheless, not enough is known about transmission of molluscum or HPV via fomites to make reasonable public health recommendations at this time.

**Recognizing Molluscum**

Molluscum infection generally is seen in preadolescent children, and particularly in immunocompromised children and adolescents. (The infection also is not uncommon in immunocompromised adults.) The molluscum virus has been found to elaborate a number of protective proteins that seem to block normal immunologic challenge must be substantiated. The molluscum virus has been found to elaborate a number of protective proteins that seem to block normal human host responses. This is important to keep in mind when considering potential therapeutic options.

Most of the papules of molluscum occur on the trunk, but about 25% of patients will present with involvement of the scalp and face. Intertriginous folds—the axillae, antecubital and popliteal fossae, and crural folds—seem
to be particularly common sites of involvement in many patients.

Traditional teaching holds that molluscum can be identified by the classic presentation of umbilicated papules. However, although it may be possible to identify some lesions that have this characteristic morphology, many more molluscum lesions are simply dome-shaped, firm, translucent papules. The differential diagnosis of molluscum includes a number of other viral infections, including varicella and, in immunocompromised patients, individual lesions of cryptococcus. In addition, small epidermal cysts, or milia, might be mistaken for molluscum; inflamed, isolated, larger molluscum lesions might be confused with pyogenic granuloma.

Biopsies are rarely indicated in the diagnosis of molluscum. Instead, the diagnosis is made clinically.

Treatment Options for Molluscum

The majority of patients—about 60% of children and adolescents—present with fewer than 15 lesions. Spontaneous involution of molluscum occurs at any time between 6 months and 5 years after their appearance in immunocompetent hosts. Unless only a few lesions are present, most parents elect to have their child treated.

One argument in favor of treatment, regardless of the number of lesions, is the possible prevention of autoinoculation and the prevention of transmission of the virus to others. However, similar to the treatment options with warts, a number of the therapies may work—although without universal efficacy—and some can cause discomfort or pain. In addition, some treatments may result in scarring, although parents should understand that, even without treatment, normal involution of the molluscum lesions may leave pitted scars or dyspigmentation.

If a patient has a small number of lesions on the trunk, axillae, or other areas that are not cosmetically sensitive, curettage is an option. Curettage should never be done without first applying a topical anesthetic. However, even over-the-counter topical anesthetics can be overapplied and result in systemic absorption and a risk for side effects.

One form of nonsurgical treatment that seems to work in many cases is cimetidine. Children and their parents should understand that a blistering response is possible with this agent, but this is transient and, in lighter-skinned children, the blister will not leave a scar. However, dyspigmentation—beyond the postinflammatory hyperpigmentation commonly seen after resolution of the molluscum lesions—is more common in darker-skinned patients.

Studies using the immune response modifier imiquimod in patients with molluscum have demonstrated promising results. In one double-blind, placebo-controlled study, 100 males between 9 and 27 years of age used imiquimod twice daily, 5 days a week for 1 month. At the end of that time, molluscum lesions had cleared in 80% of patients who used imiquimod versus 16% with placebo. In a second study, an open-label trial, 15 children between 4 and 11 years of age were treated with imiquimod three times weekly. Two patients left the study because of local irritation. Of the 13 who completed the study, 9 had either complete or partial responses. (A partial response was defined as a decrease in lesion count from baseline.) Through its known immunologic mechanism, imiquimod may prove useful for the treatment of molluscum. Controlled studies will define its true utility in this regard.

Because imiquimod does not cause blistering the way cantharidin does, imiquimod may be preferred for treating lesions on the face and in the groin area, particularly near the orifices.

A 3-month course of treatment with cimetidine is an option that may be tried in selected cases. It is occasionally useful when other treatments fail. Cimetidine also may be useful for patients with atopic dermatitis, or in a child with a large number of lesions for whom curettage or topical treatment with cantharidin or imiquimod is impractical.

Conclusion

Whether patients have warts or molluscum, it is important to emphasize to parents that no treatment is universally effective, and elimination of lesions—particularly warts—may take several treatment attempts with more than one modality. In addition, parents should understand that the appearance of new lesions does not necessarily indicate a recurrence of a previous outbreak, but may be the result of a clinical manifestation of lesions that had been incubating in the same area. Both warts and molluscum, while benign conditions, represent therapeutic challenges for generalists and dermatologists alike. Because of the possibility for autoinoculation and spread to other individuals, effective treatment is often required. Physicians must be aware of a variety of management options when evaluating such patients.

References


Managing Children With Atopic Dermatitis

Continued from page 6

wo types of nevi, or moles, are seen in the pediatric patient: the congenital nevus, which appears in the first year of life (although not necessarily present at birth) and the acquired nevus, which appears after 18 months, with peaks of incidence in the preschool years and during adolescence.

**Evaluation and Management of Congenital Nevi**

The issue of when congenital nevi should be excised is controversial in pediatric dermatology. Congenital nevi are associated with an increased risk for malignancy. If a nevus is less than 1 cm in diameter, the risk for malignant conversion is small—less than 1% over the lifetime of the patient. Nevertheless, any congenital mole should be monitored throughout the patient’s lifetime. In some cases, small nevi present cosmetic issues, and despite the limited risk for malignancy, such factors must be considered in decisions about removal.

Congenital moles that are larger than 1 cm and have a benign appearance also do not require removal, but the larger the mole, the greater the risk for malignancy to occur, and the greater the need for monitoring these nevi for suspicious changes. When a child has a congenital nevus between 1 and 3 cm in diameter, consider the anatomic location in any decision about whether to remove or observe the nevus. If the nevus is in a location that will make it hard to monitor over time, such as on the scalp, I may recommend to the parents that the lesion be removed, only because the chances of safely following any changes in that mole are reduced. Other difficult locations include the groin, the bottom of the foot, and the middle of the back.

Any mole that has atypical features—such as multiple colors, irregular borders, or rapid growth—warrants an evaluation. In such cases, removal is probably prudent. The removal of very large congenital nevi—so-called garment moles—is probably less controversial. These rare nevi cover a large portion of the body and occur in approximately 1 in 20,000 children. Garment nevi are associated with an increased risk for malignancy in the range of 10% to 15%. Surgery to remove these lesions involves serial excision or tissue expansion to remove as much of the nevus as possible to minimize the risk for malignancy.

**Acquired Nevi**

Acquired nevi, commonly referred to as moles, generally appear for the first time in Caucasian children between 18 months and 2 years of age. They initially appear to be, and frequently are mistaken for, freckles.

Three types of nevi are recognized. Junctional moles are flat, nonpalpable, brown skin lesions. Compound nevi are usually brown and elevated. Intradermal nevi are moles that are skin-colored and elevated. The appearance of more nevi on sun-exposed areas of the body, compared with nonexposed areas, suggests that ultraviolet light exposure may influence the site of mole development.

The appearance of new moles and slow growth of moles with a gradual increase in thickness are normal changes during childhood. The layperson’s perception is incorrect that elevation of a mole or hair growing from a nevus is abnormal. Approximately 20% to 30% of moles progress from being lentiginous (or flat) to being elevated. Such changes are expected, particularly during puberty. Moles may continue to be acquired up through about age 30; approximately 20 to 30 moles appear in the average Caucasian by age 30.

**Caveats About the ABCD Rules**

The ABCD guidelines were developed for adults for self-examination of nevi. According to this mnemonic, a nevus should be considered suspicious if it becomes asymmetrical (A), develops irregular borders (B), changes color (C), or increases in diameter (D) beyond 6 mm, or the size of a pencil eraser.

In examining color in moles, physicians and parents should understand that this feature is individual. Mole color differs from person to person.

However, both physicians and parents should recognize that even if a mole meets all the ABCD criteria for being normal, it is abnormal if it does not match all the other moles on an individual’s body. In addition, parents who have learned the ABCDs should be advised that these rules do not necessarily apply to nevi in children, particularly congenital nevi. For example, congenital nevi often are asymmetric and larger than 6 mm. Finally, changes in nevi in children are more significant if they are focal. If an entire mole darkens or gets uniformly larger, this is of less concern than if one portion of a mole undergoes these changes.

**Melanoma Risk**

The general population risk of melanoma in Caucasians is currently estimated to be 1 in 70. Melanoma is the leading cause of cancer-related death in individuals between 20 and 40 years of age.

Pediatricians and family practitioners should be aware that family history has significance for evaluating nevi in children. A child with a first-degree relative who had or has melanoma is at increased risk for malignancy, but a relationship more distant than this confers no greater risk. If a child has a parent who has multiple atypical nevi, the child may have an increased lifetime risk for melanoma, compared to the general population; atypical nevus syndrome is heritable and conveys an increased risk for melanoma.

Parents who are concerned about their family history of atypical moles or a family history of melanoma frequently ask how often their child should be seen for a physical examination to evaluate nevi. These parents can be reassured that melanoma is quite rare in the childhood years, and—unless some changes occur in these lesions—examinations by a dermatologist can be performed once in the elementary school years (prepuberty), once in the middle school grades (around the time of puberty), and once in high school.

In addition to being alert for possible malignant conversions in nevi, all physicians can contribute to controlling the melanoma epidemic by impressing on parents the importance of using sunscreens on their children from very early in life. Although no relationship has been definitively demonstrated yet between chronic sun exposure and melanoma, blistering sunburns have been shown to increase the frequency of this type of skin cancer.
Scabies is a contagious infestation caused by the mite Sarcoptes scabiei. Patients become symptomatic within 2 to 4 weeks after close personal contact with an infested individual; the onset of symptoms coincides with the patient’s sensitization to the infestation.

The infestation often presents with a variety of lesions, including papules, nodules, vesicles, pustules, and even large bullae. Crusting may be prominent, particularly (although not exclusively) with smaller lesions. The classic lesion, erythematous, slightly vesicular linear burrows, may be evident but are not always present. When burrows appear, they may be no more than a few millimeters long and may appear anywhere on a patient’s body.

**Diagnosing Scabies**

The diagnosis is made clinically, based on the appearance and distribution of the lesions. The distribution of scabies tends to vary with the patient’s age. In infants, lesions most commonly appear on the trunk, breasts, and genitalia. In older children, adolescents, and adults, scabies lesions are more commonly seen in the flexural areas, interdigital web spaces, wrists, and axillae. However, involvement of the trunk, breasts, and genitalia is not uncommon.

The differential diagnosis may include any condition that can present with dermatitis, papules, crusts, or vesiculation, so it is not unusual for the diagnosis of scabies to be missed occasionally, even by experienced dermatologists. Conditions to be ruled out include atopic dermatitis, dyshidrotic eczema (because of vesicles or bullae on the hands and feet), contact dermatitis, an isolated bacterial infection (such as impetigo or folliculitis), insect bites, and the congenital dermal sinus of the scalp. In addition, scabies can be confused with dermatitis of the hands and feet, pustular eruption known as infantile eczema, insect bites, and the congenital dermal sinus of the scalp. In addition, scabies can be confused with dermatitis of the hands and feet, pustular eruption known as infantile eczema, insect bites, and the congenital dermal sinus of the scalp.

**Treatment Considerations and Options**

Families should be advised that treatment involves both the patient and all potential contacts, whether or not those contacts have symptoms or other evidence of scabies infestation. Such individuals may be bringing the mites into the home and may be the source of reinfection even if the patient is successfully treated. In addition to other residents in the household, babysitters, a friend or family member who spends time in the home, or an attendant who cares for a disabled family member, for instance, are examples of potential sources of infection. The decision to treat depends on how close the contact is. Close contacts (family members and others, such as caregivers) should be treated. Casual contacts can be advised to seek treatment if symptoms of scabies infestation appear.

A traditional treatment for scabies that is still used occasionally is 5% to 10% precipitated sulfur in petrolatum, applied daily for 3 to 4 days. Because of the odor from the sulfur and the messiness owing to the petrolatum base, this is not the most convenient or attractive treatment, but it should be considered for patients in whom other treatments may not be the most desirable, such as very young children or pregnant women.

Biopsies usually are performed only if another diagnosis is being considered for which a biopsy is indicated.

Finally, scabies is a diagnosis of exclusion, and it is important to avoid overdiagnosis. Treatment for scabies should not be prescribed unless the diagnosis is definitive. Agents used to eliminate mites tend to dry the skin and can be irritating, so if the problem actually is dermatitis or eczema, therapy can exacerbate those other conditions.

**Confirmation of the diagnosis may be made by microscopic examination of scrapings from burrows of fresh vesicles. This material is mounted on a slide and mineral oil or potassium hydroxide (KOH) is added. A mineral oil preparation allows visualization of active, live mites, whereas KOH kills scabies; however, KOH is less messy than oil and still allows identification of mites, eggs, or feces.**

**Figure. Scabies on the Plantar Surfaces**

The sole of the foot is a typical site of scabies infestation in infants. The diagnosis is confirmed by microscopic examination of scrapings from burrows.

Photo courtesy of Dr. Moise L. Levy.  

Currently, the standard of care for scabies therapy is 5% permethrin cream, which should be applied to all exposed skin surfaces—not just affected areas—from the neck down. It is important to work this product under fingernails because mites can be picked up while scratching. The cream is applied overnight and washed in the morning. In addition, on the morning following treatment, bed linens should be removed and laundered.

In cases in which permethrin is ineffective, oral ivermectin, at a single dose of 200 μg/kg, may be considered. Unfortunately, ivermectin can be difficult to obtain in many locations. Unfortunately, this product is not a particularly effective agent for killing mites. Lindane, another topical pesticide, was once widely used to treat scabies and lice, but the neurologic complications and environmental concerns associated with this agent have caused many clinicians to avoid it. Nevertheless, when used as directed on unbroken skin, lindane should not be automatically eliminated as an option, particularly because this agent is considerably less expensive than permethrin in most areas, and cost is an important consideration for some families.

None of these scabicide agents is uniformly effective in every patient. For this reason, re-treatment should be considered within 7 to 10 days.

In addition to therapy to eliminate the scabies mite, symptomatic therapy for pruritus and inflammation should be prescribed. Topical corticosteroids or oral antihistamines often are useful.

**Conclusion**

Scabies remains an infestation that must be considered when evaluating a patient with a pruritic papular or vesicular skin eruption. The eruption, as described, can be easily missed and, ironically, is often overdiagnosed as well. Most traditional therapies are effective if appropriately used.

**Reference**

Acne Therapy: An Overview

Teenage Acne

Acne in teenagers is a disease of pilosebaceous glands. Because these glands are found in highest concentration on the face, forehead, cheeks, chin, chest, and back, these are the sites at which acne typically occurs.

Treatment of teenage acne is influenced by the pathogenesis of the condition in this age group. It is believed that the same hormones that regulate the onset of puberty cause increased sebum production in the pilosebaceous glands. In addition, the same pubertal hormones adversely affect the shedding of the skin cells at the neck of the gland where it opens to the surface of the skin. The opening becomes more easily clogged, and the result is a more active gland with contents that are “trapped” in place.

The initial consequence of this process is a microscopic lesion—a microcomedone. As the lesion enlarges, it becomes visible and is known as a comedone, either closed (commonly known as a whitehead) or open (a blackhead). A blackhead results when melanin accumulates and oxidizes in the opening.

Inflammatory acne lesions are caused by the proliferation of *Propionibacterium acnes* in response to the increase in sebum. The metabolic byproducts of *P. acnes* cause the release of proinflammatory fatty acids and materials chemotactic for neutrophils. In addition, acne lesions may break, releasing their contents into the dermis and provoking what is, essentially, a foreign-body reaction.

Topical Therapy (Table)

Because the initial lesion in acne is always a microcomedone, the ideal acne regimen for patients with mild to moderate acne might contain an agent with comedolytic properties. At this time, the best comedolytic agents available are topical retinoids. The three types currently available—tretinoin, adapalene, and tazarotene—are available dispensed in a variety of formulations. Irritation is the main side effect associated with topical retinoids. However, this problem usually can be managed by trying different agents and/or by manipulating the frequency of application and amount used.

Azelaic acid has antibacterial activity and also seems to have comedonal and antiinflammatory properties. Azelaic acid may be a reasonable alternative for patients for whom retinoid therapy fails. Mild stinging is a side effect of this agent, but tends to resolve with continued use.

Benzoyl peroxide, the most commonly used agent to treat acne, is available both by prescription and over-the-counter (OTC) and in a variety of formulations (gels, ointments, liquids) and concentrations (ranging from 2.5% to 10.0%).

Benzoyl peroxide has some comedolytic properties, is known to be helpful for treating inflammatory lesions, and has antibacterial properties. Thus, this agent can be helpful for treating both comedonal and inflammatory acne. Benzoyl peroxide can be irritating and can cause an allergic reaction in some patients. In addition, patients who use this agent should be cautioned to wash their hands after applying the medication because it can discolor fabrics.

Table. Topical Agents for Acne

| Retinoids (tretinoin, adapalene, tazarotene) |
| Azelaic acid |
| Benzoyl peroxide |
| Salicylic acid |

Topical antibiotics (eg, clindamycin and erythromycin), alone or in combination with benzoyl peroxide

Salicylic acid is an ingredient in many OTC acne washes. Although salicylic acid has comedolytic properties, most other agents available are far superior for this purpose.

Topical antibiotics—most commonly, clindamycin and erythromycin—also have a role in the treatment of inflammatory acne. Formulations are available with these agents as monotherapy or in combination with benzoyl peroxide. The advantage of combining the topical antibiotic with benzoyl peroxide is that the latter agent may decrease the ability of *P. acnes* to become resistant to the antibiotic.

A reasonable amount of time is required to determine whether an anti-acne regimen is effective. Substantial change should be seen in approximately 6 weeks.

Oral Medications

Oral medications are indicated for patients who do not respond to topical therapy or for those with moderate to severe inflammatory or comedonal acne. These fall into three main categories: oral antibiotics, isotretinoin, and, for females, oral contraceptives (OCs).

The agents in the tetracycline family typically are the first-line oral antibiotic medications, but erythromycin and other broad-spectrum agents also are used frequently. The most difficult issue with tetracycline is that it must be taken 1 hour before or 2 hours after a meal—a schedule that proves problematic for most teenagers. In addition, because the molecule binds to calcium, special care must be taken to avoid interactions with calcium-containing foods.

Doxycycline and minocycline are not associated with these problems. Patients using doxycycline, however, should be cautioned about the potential for heightening photosensitivity while using this drug. In addition, doxycycline can be irritating to the esophagus and stomach and so should be taken with a full glass of water and not immediately before lying down. Minocycline is extremely well tolerated, but some patients experience side effects such as dizziness, tinnitus, or nausea. If these occur, the medication should be discontinued and another antibiotic should be used instead. A lupus-like syndrome is a very rare side effect with chronic use of minocycline.

Misconceptions about the use of oral antibiotics in patients with acne often result in their being discontinued too soon. These agents work because of their antibiotic action, but they also appear to have antiinflammatory properties. Generally, these medications should be used in blocks of therapy lasting a minimum of several months. Medication may be withdrawn periodically to determine whether the disease remains under good control with topical therapy alone.

Gastrointestinal (GI) upset is a common side effect of oral erythromycin, making this drug a less popular choice. Although derivatives of this agent are less likely to be associated with GI symptoms, these drugs tend to be more expensive than the parent compound.

Treatment with other oral antibiotics may be considered for patients who fail to respond to tetracyclines or erythromycin drugs. These include cephalosporins and trimethoprim-sulfa-methoxazole.

Isotretinoin has been used for more than 20 years for the treatment of resistant nodular acne in teenagers and older patients. It is an extremely effective medication, even for those with the most severe, cystic, or scarring types of acne lesions. Ninety percent or more of patients treated with this drug have excellent

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responses after a typical 4- to 5-month course of isotretinoin at approximately 1 mg/kg body weight per day.\textsuperscript{1,2} Approximately 65% to 80% of patients either do not experience a recurrence of their disease after treatment or, if lesions do recur, the outbreak is not nearly as severe as before treatment. After a second course of treatment, if required, the response rate increases to more than 85%.\textsuperscript{2} Isotretinoin is a potent teratogen and clinicians must be registered to prescribe this medication; female patients of childbearing age must have monthly pregnancy tests, and treatment with this drug must be discontinued if pregnancy is detected.

The most common side effects of oral isotretinoin are dryness of the mucous membranes (the lips, in particular), face, and eyes. Muscle aches have been reported in teenagers more commonly than in any other group. The question of whether isotretinoin causes depressive symptoms remains open,\textsuperscript{14} although the label for this medication carries a warning concerning this possibility.

Several OCs are now approved specifically for the treatment of acne and are effective for both comedonal and inflammatory acne. These agents work by modulating hormonal levels. Efficacy with OCs is approximately the same as for oral antibiotics, but not all patients who respond to one class of drugs will necessarily respond to the other.

Other Types of Acne Treatment

Prior to the availability of effective oral agents, intralesional injection of lesions was the mainstay treatment of nodular acne. It remains a viable option, especially for the patient who has just a few nodules—too few to warrant the use of oral isotretinoin.

Comedone extraction is a procedure performed in the dermatologist's office. Although this technique can temporarily eliminate visible lesions, it does nothing to prevent new comedones from forming and, thus, should never be considered the mainstay of an acne regimen.

One experimental treatment for acne is the use of intense blue light, which is purportedly absorbed by compounds within the \textit{P. acnes} organism, causing bacterial death. Another line of research involves the use of photodynamic therapy to treat resistant nodular acne.

Neonatal Acne

Neonatal acne is a condition characterized by small, inflammatory lesions, once thought to result from the effect of maternal hormones on the neonatal sebaceous glands. Newer evidence suggests that in some cases, children with these lesions actually may have a \textit{Pityrosporum} infection.\textsuperscript{3} Such infections may be appropriately treated with observation alone or with a topical antifungal agent.

No data are available regarding the safety of benzoyl peroxide or other topical agents in the neonates. However, such agents have been used to treat neonatal acne, and there have not been reports of serious side effects.

Acne in Older Infants

In children older than 3 years of age, lesions that appear to be acne may be a presenting sign of precocious puberty. However, most infants and young children with acne are otherwise healthy, and in the absence of any other clinical signs, an endocrine workup is not warranted.

The most common problem with acne in older infants, toddlers, and young children is the lesions may be severe, but the treatments available are the same as for teenagers and adults. Unfortunately, some of the most effective treatments—such as tetracycline and its derivatives—are not appropriate for this age group. Topical agents can be tried, but some children respond poorly; some cases have been reported in the literature of children as young as 3 or 4 years of age with severe and even scarring acne who respond to nothing but isotretinoin.\textsuperscript{6}

Conclusion

Pediatricians and family practitioners may wish to limit their treatment to topical medications, or they may choose to become familiar with the details of antibiotic therapy. However, in cases of moderate to severe or resistant acne in which OCs or isotretinoin are possible therapies, referral to a dermatologist is appropriate.

References

Tinea Capitis and Other Cutaneous Fungal Infections

Tinea, the ring-shaped cutaneous fungal infections commonly known as ringworm, may affect any part of the body (Figure and Table). These infections may be divided into those that affect the soft keratin of the skin and those that affect the hard keratin in the hair and nails. Treatment options differ according to these classifications. Soft keratin infections can be treated with topical agents; hard keratin infections—tinea unguium (onychomycosis) and tinea capitis—must be treated with oral agents.

Children with primary and secondary immunodeficiency are among the most susceptible populations for acquiring fungal infections of the skin. Among the immunocompetent populations, tinea capitis tends to be a problem among children in day care centers and elementary schools. Tinea corporis should be suspected in teenagers who engage in close contact sports, such as wrestling, and who present with round, scaly lesions of the trunk and extremities.

Tinea capitis, in particular, is a common problem in children, especially in urban populations. The most common cause of tinea capitis in the United States is *Trichophyton tonsurans*. However, the dog and cat ringworm, *Microsporum canis*, also may cause tinea and may be one of the more challenging fungal infections to treat, often requiring higher dosages and longer treatment regimens.

Treatment Options

Tinea of the body, hands, face, feet, and groin areas is usually effectively treated with one month of a topical antifungal agent. The clearance of tinea capitis may require oral medication for 2 months or more. Onychomycosis usually requires longer oral dosing regimens.

**Table. Fungal Infections by Affected Anatomic Site**

<table>
<thead>
<tr>
<th>Fungal Infection</th>
<th>Affected Anatomic Site</th>
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</thead>
<tbody>
<tr>
<td>Tinea capitis</td>
<td>Scalp/hair</td>
</tr>
<tr>
<td>Tinea pedis (athlete’s foot)</td>
<td>Foot</td>
</tr>
<tr>
<td>Tinea faciei</td>
<td>Nonhairy areas of the face</td>
</tr>
<tr>
<td>Tinea corporis</td>
<td>Body</td>
</tr>
<tr>
<td>Tinea manuum</td>
<td>Interspinal spaces of the hand</td>
</tr>
<tr>
<td>Tinea cruris</td>
<td>Groin</td>
</tr>
<tr>
<td>Tinea unguium (onychomycosis)</td>
<td>Nails</td>
</tr>
</tbody>
</table>

Oral griseofulvin has a long history of safe and effective use. The disadvantage of therapy with this antifungal agent is that it must be taken for a minimum of 2 months. Failure to clear tinea capitis with griseofulvin may result from underdosing. The dosage regimen for micronized griseofulvin is 20 to 25 mg/kg/day for at least 2 months. For ultramiconized griseofulvin, 15 mg/kg/day for 2 months should be prescribed.

For patients who do not respond to griseofulvin, treatment with oral terbinfine is an alternative medication. Some clinicians consider using itraconazole in children, but I prefer to avoid this agent. My experience is that the liquid formulation of itraconazole may cause diarrhea, and, more importantly, the labeling of this drug in capsule carries a warning that it may cause congestive heart failure. In the future, fluconazole liquid may become an option; this agent is currently under investigation for tinea capitis and onychomycosis in pediatric patients.

In addition to oral therapy, a sporicidal shampoo should be used twice weekly for the duration of treatment. The shampoo should be left on the scalp for 10 minutes and then rinsed off. As these shampoos tend to be drying, advise the parent or patient that they may also use a cream rinse or conditioner. Like topical antifungal medications, sporicidal or antiseborrheic shampoos are ineffective as monotherapy for tinea capitis.

Managing Fomites

Organisms that cause cutaneous fungal infections may persist for some time on fomites. Transmission via fomites should be suspected when children experience chronic reinfections, but, unfortunately, information is lacking to guide clinicians and parents in the management of fomites. As a result, it is not possible to advise parents or patients about the elimination of fungal organisms or to issue public health recommendations regarding cutaneous fungal infections with the feasibility of treating fomites effectively.

Until evidence is available, the best a clinician can do is advise parents to use common sense. Children should not share headwear, grooming tools (combs, brushes), or other objects that come into contact with the head (headbands, “scrunchies,” and so forth). In addition, parents should be alert to the habits practiced in barber shops and beauty salons, and ensure that combs, brushes, and clippers are always cleaned in a germicide/fungicide agent between customers. Although these are not proven sources of infection, they certainly are potential avenues of fomite transmission.

Conclusion

Fungal infections are an ongoing public health problem in pediatric populations. School-age children and those who attend day care are particularly likely to acquire fungal infections of the hair, nails, and skin. Clinicians and caregivers must understand that fungal infections of the hair/scalp (tinea capitis) and nails (onychomycosis) cannot be successfully treated with topical agents because the currently available products do not penetrate hard keratin. These infections require treatment with systemic agents, given for an adequate duration and in sufficient dosages.
Protection From Bites, Stings, and Photodamage

Bites from insects and spiders usually are readily identifiable. Among the most common, depending on the region of the United States, are bites from mosquitoes, ticks, fleas, chiggers, and fire ants, and stings from wasps, bees, and hornets. Spider bites are less common but not unusual.

In most cases, bites and stings do not represent serious medical problems. However, in certain regions of the US, Lyme disease and Rocky Mountain spotted fever are endemic, tick-borne diseases. A recent concern is the transmission of West Nile virus from mosquitoes. In addition, some individuals are susceptible to acute anaphylactic reactions from bites and stings.

**Repellents: What's Safe for Children?**

N,N-Diethyl-meta-toluamide (DEET), the most popular insecticide ingredient in use in the world today, was developed by the United States Army in 1946 and first sold to the general population in 1957. Seventy manufacturers make approximately 230 DEET-containing products. DEET provides protection from a number of insects and is particularly effective against mosquitoes.

The Environmental Protection Agency currently prohibits child safety claims on insect repellent labels. The wording “generally recognized as safe” is permitted for products that qualify, however; toxicity is not known to be a problem for products so designated if they are used according to the directions on the label. In studies with rats and mice, it has been established that DEET is not a specific neurotoxin. There is no evidence that children less than 6 years of age are at greater risk to develop adverse events than older children.

DEET-containing products should be applied to the skin or clothing before exposure to outdoor areas where mosquitoes are likely to bite. Application should occur in well-ventilated areas, and care should be taken to avoid the mucous membranes. Additional applications to the skin are not required if insects are not biting. Protection lasts for weeks on clothing stored in plastic bags after being sprayed with DEET. It is helpful to spray the clothing of children bound for summer camp, for example, to reduce their risk for insect bites.

Permethrin, another common insect repellent, is a plant-based product derived from chrysanthemums. Unlike other insect repellents, permethrin is unique because it also has insecticidal action and is lethal for ticks, preventing tick attachment and reducing the risk for tick-borne diseases. Therefore, in areas where such diseases are endemic, permethrin is the agent of choice.

Permethrin is applied to clothing, outdoors, and the clothing should be allowed to dry before it is worn. The product should be reapplied after every fifth laundering. Like DEET, permethrin is considered to be safe for children if it is used according to the manufacturers’ guidelines. Permethrin is poorly absorbed by the skin and has been shown to have low toxicity in mammals; in addition, it is rapidly inactivated by ester hydrolysis.

Permethrin cream, used for the treatment of scabies, is approved by the US Food and Drug Administration for direct application to the skin in children as young as 2 months of age and in a concentration of 5%. No studies have been conducted to date using topical prescription permethrin-based products as insect repellents or insecticides.

**Parents frequently ask about insect repellents made from botanical products.** One such product, containing the active ingredient p-methane-3,8-diol, at a 10% concentration, is effective against mosquitoes, black flies, gnats, and no-see-ums.

In addition, some recent evidence has demonstrated that plant-based repellent activities of thyme indicates essential oil from this herb has a protection rate of 91% at a concentration of 0.05%, and that it is a rich source of insect-repellent molecules known as monoterpenes. The potency of this repellent is stronger than that seen with DEET.

Citronella is less effective than other insect repellents against mosquitoes. It provides a protection time of 30 to 120 minutes. Citronella is safe for topical use but can cause aspiration pneumonia if swallowed.

Devices for repelling mosquitoes may be considered, but the efficacy and mechanisms of action of most is questionable. So-called “zappers” have the goal of reducing the mosquito population in a given area, but because they work by attracting insects to them, they actually may increase the risk for insect bites. A doughnut shaped device placed in water may be useful to reduce mosquito populations in areas with a pond or other standing water. This device is a larval killer that treats up to 100 square feet of surface water for up to 30 days. It is EPA-registered in all 50 states and has been determined to be environmentally sound.

For further information on these topics, several Web sites are useful. These are provided in Table 1.

**Sun Protection for Children**

Many of the consequences of exposure to ultraviolet (UV) radiation have been recognized for many years, but the exact mechanisms of sun damage—or photodamage—continue to be studied and described. For example, it is well known that photodamage is a cumulative process that begins in childhood, and that severe sunburns early in life increase the risk for both melanoma and nonmelanoma skin cancer. In addition to the acute and chronic consequences of UV light exposure that are seen on the skin (Table 2), the epithelial tissue of the eyes also suffers damage, a fact that has not been emphasized in the past.

Physicians and laypersons are familiar with the sun protection factor (SPF) photo-
toprotection ratings. SPF was developed specifically to rate sunscreens and indicates the amount of time protection lasts compared with the exposure time that would result in a sunburn without sunscreen. Remember, however, that SPF primarily designates the ultraviolet-B spectrum of photoprotection, and it is important that children and adults have protection from the entire spectrum of ultraviolet light.

The methods of sun protection for the skin include physical shading, wearing tight-weave clothing, and chemical and/or physical sunscreens and sunblocks. The least reliable of these is shade, as from an umbrella or tree. Shade is thought to provide the equivalent of SPF 15, but light reflected from surrounding areas would decrease that protection.

**Clothing**

Denim is a good example of tight-weave clothing that provides photoprotection equivalent to approximately SPF 8. In addition, a number of companies manufacture clothing specifically for sun protection, including gloves, hats, and scarves. As an alternative, parents may want to wash regular clothes in a photo-protective laundry additive that is available in grocery stores. The protection lasts for a number of subsequent washings and is a low-cost way to enhance the photoprotective value of clothing.

**Sunscreens and Blocks**

Physical sunscreens work by reflecting light. This class of photoprotective agents includes the classic product known as zinc oxide as well as titanium dioxide. Today’s formulations of these products are more cosmetically elegant than those available in the past (recall the white noses on lifeguards, for example); the zinc and titanium are contained in smaller particles that can be rubbed into the skin. Products containing iron oxide and other physical blocking agents also are available.

The choice of product is individual, but children, in particular, should use a sunscreen or sunblock with at least an SPF of 30. My personal recommendation is to avoid combination sunscreen and insect-repellent products. Patients should reapply sunscreens throughout the day, especially if they are swimming or in wind, but insect repellents—particularly those containing DEET—should not be reapplied frequently.

A problem that has been identified with sunscreens is that most consumers use an insufficient amount—usually far less than what is indicated on the label. One way to achieve adequate coverage is to instruct parents and patients to “layer” products. First, apply a sunscreen product containing a chemical sunscreen such as parasol, oxyccinnamates, or oxybenzones. Next, apply a second layer, using a physical sunscreen containing zinc oxide or titanium dioxide. This method results in the application of more sunscreen and reduces the chance that areas of the skin will be missed. In addition, let parents and patients know that products labeled as “water-resistant” lose their SPF after 40 minutes in the water; those labeled “waterproof” lose SPF after 90 minutes of exposure to water.

In acne-prone patients, a gel-based sunscreen may be the least comedogenic, although it is difficult to predict an individual patient’s response to specific products. It is helpful to provide samples to patients with eczema or sensitive skin and have them try these products on their forearms (not the face) to determine their skin’s reaction. As a general rule, remember that the more “runny” the emollient products are the more likely they are to contain an ingredient (such as propylene glycol or alcohol) that can cause burning or stinging in sensitive individuals. For patients with sensitive skin, consider recommending a generic zinc oxide or titanium dioxide sunscreen. Because these products contain nothing but zinc oxide and/or titanium dioxide in petrolatum, they rarely cause burning or stinging, and they have an SPF of 45 or greater.

### Table 2. Acute and Chronic Consequences of Photodamage

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
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<tr>
<td>Sunburn</td>
<td>Cosmetic changes</td>
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<tr>
<td>Sunburn</td>
<td>Wrinkles</td>
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<tr>
<td>Increase in nevi</td>
<td>Telangiectasias</td>
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<td>Lentigines</td>
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<td>Multiple nevi</td>
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<td>Loss of elasticity</td>
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<td>Sebaceous hyperplasia</td>
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<td>Increase in nevi</td>
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<td>Premalignant lesions</td>
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<td>Cataracts</td>
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<td>Macular degeneration</td>
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For teenagers who consider a tan a “must-have,” advise the use of artificial tanning products. However, also caution teenagers that these products do not contain sunscreens, so photodamage can still occur. Instruct them to apply the sunscreen and allow it to dry before applying the artificial tanning product.

**Eye Protection**

Before age 10, children’s ocular lenses are clear, regardless of their eye color. Thus, younger children are most susceptible to eye injury from UV light. After this age, the lens becomes cloudier, filtering out some UV light and providing some natural protection. It should be a goal of every clinician who deals with children to teach and encourage eye protection early, as part of an entire program of sun protection.

The ideal sunglasses have polycarbonate plastic lenses and fit close to the eyes, wrapping around the face. Polycarbonate is a relatively inexpensive material that provides good protection against both UVA and UVB radiation. In addition, this plastic provides excellent protection from impact injury (from a small projectile such as a BB, for example).

**Conclusion**

Caring for the pediatric patient involves providing education on the prevention of common problems such as insect bites and sunburn. A clear understanding of the products available to help patients and their parents will ensure that a specific regimen to protect both the skin and the eyes will be discussed in the outpatient setting. The overview provided here covers anticipatory guidance tips that will help caregivers avoid some of the most common and troublesome skin conditions that may affect children. In addition, attention to measures that prevent photodamage to the skin and eyes in childhood will have an effect on protection against long-term health problems such as skin cancers and ocular disease.

### References

Instructions: For each question or incomplete statement, one answer or completion is correct. Seven of 10 correct responses are required for credit. Circle the most appropriate response.

1. Which one of the following agents is lethal for ticks?
   a. Citronella
   b. DEET
   c. Monoterpenes
   d. Permethrin

2. By the age of puberty, or shortly thereafter, complete clearance of atopic dermatitis occurs in ___ of patients.
   a. 20% to 40%
   b. 30% to 50%
   c. 40% to 60%
   d. 70% to 90%

3. Blockade of the production of inflammatory mediators is the mechanism of action of pimecrolimus and tacrolimus, two agents in a class of drugs known as:
   a. Calcineurin inhibitors
   b. Monoterpenes
   c. Class IV corticosteroids
   d. Immune response modifiers

4. All of the following are topical retinoids that are effective comedolytic agents except:
   a. Adapalene
   b. Azelaic acid
   c. Tazarotene
   d. Tretinoin

5. A new immunologic approach for the treatment of molluscum contagiosum involves the topical use of:
   a. Cantharidin
   b. Cimetidine
   c. Imiquimod
   d. Tazarotene

6. The current standard of care for scabies is:
   a. Crotamiton
   b. Ivermectin, a single oral dose of 200 μg/kg
   c. Permethrin cream, 5%
   d. Precipitated sulfur in petrolatum, 5% to 10%

7. Topical treatments for flat warts in children include all of the following except:
   a. Cimetidine
   b. Imiquimod
   c. Retinoids
   d. Salicylic acid

8. The clearance of tinea capitis:
   a. Is often spontaneous
   b. May be achieved with a topical antifungal
   c. May be achieved with daily use of a sporicidal shampoo
   d. Requires the use of an effective oral medication

9. Garment nevi are associated with an increased risk for malignancy in the range of:
   a. 1% to 5%
   b. Between 10% and 15%
   c. Between 20% and 35%
   d. Greater than 35%

10. Scaly rashes involve inflammation in the:
    a. Epidermis
    b. Dermal-epidermal junction
    c. Dermis
    d. Stratum corneum

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