

Where in the World Did You Get That Rash?

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Practice Gaps

The challenge to diagnose cutaneous eruptions and lesions in patients who have spent time in foreign countries is increasingly common. With the advent of increased global travel, foreign adoptions, immigration, and refugee seekers, rashes that were once relegated to the realm of the exotic and likely to show up in a tropical diseases clinic may now present to a general pediatrician. Furthermore, the pediatric traveler is at increased risk for dermatoses. (1) It behooves the practitioner to be aware of these skin findings, to be able to recognize them and distinguish them from other skin conditions.

Objectives After completing this article, readers should be able to:

1. Identify and classify rashes by main morphologic patterns.
2. Develop a broad differential diagnosis and diagnostic approach for a rash in a returned pediatric traveler based on initial morphology, history, epidemiology, and other clinical features.
3. Consider both infectious and noninfectious causes of skin disorders presenting in a patient with a travel history.
4. Outline the basic investigations and principles of management for travel-acquired and non-travel-acquired dermatologic illnesses.
5. Discuss appropriate pretravel preventive measures with patients and caregivers.

EDITOR'S NOTE

Along with the current COVID-19 (coronavirus 2019) outbreak, this review article draws attention to the fact that international travel can introduce unexpected diseases throughout the world.

Joseph A. Zenel, MD
Editor-in-Chief

Figures for this article are at <http://pedsinreview.aappublications.org/content/41/4/184>.

INTRODUCTION

In patients with a travel history, there are different frameworks for organizing an approach to rashes. One approach is to consider the infectious agents present commonly in the countries of exposure. However, this approach will miss many more mundane

AUTHOR DISCLOSURE Ms Eshtiaghi has disclosed no financial relationships relevant to this article. Dr Weinstein has disclosed that she has led advisory board meetings for Pfizer related to a new eczema product; has served as a consultant on skin care for Paladin Labs; has served as a consultant for a continuing medical education program for pharmacists on eczema management for Rx Briefcase; has served as an advisory board member for Johnson & Johnson on eczema and sun protection products; has served on an advisory board for Sanofi-Genzyme; and has received funds to develop an eczema teaching program for patients and families through a grant provided to the Hospital for Sick Children Foundation by La Roche-Posay. This commentary does contain a discussion of an unapproved/investigative use of a commercial product/device.

ABBREVIATIONS

ACD	allergic contact dermatitis
CD	cercarial dermatitis
CL	cutaneous leishmaniasis
CLM	cutaneous larva migrans
DF	dengue fever
HFMD	hand, foot, and mouth disease
HSV	herpes simplex virus
KD	Kawasaki disease
PCR	polymerase chain reaction
PR	pityriasis rosea
RT-PCR	reverse transcriptase polymerase chain reaction

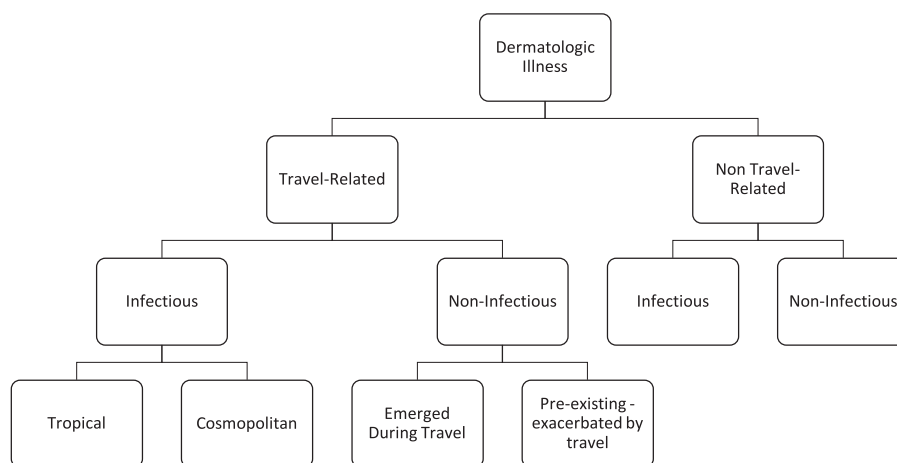


Figure 1. A suggested approach to dermatologic illness in a returning traveler.

infections, noninfectious causes of skin disease, and perhaps disease unrelated to travel but occurring coincidentally with travel.

Perhaps the most practical approach to skin lesions in those with a travel history is to consider the morphology of the presenting skin findings and to consider the infectious (both tropical and cosmopolitan) as well as noninfectious (both travel-related and non-travel-related) causes of similar skin features. Considering rashes by morphologic pattern allows for a practical starting point for diagnosis. Herein, 7 morphologic patterns are examined in detail with approaches to diagnoses within each group (Table 1).

The focus will be on 1) the approach to patients with skin lesions and a history of time spent in other locations, 2) review of the common eruptions seen in such patients and how to distinguish these eruptions from those unrelated to travel, and 3) some key eruptions that should not be missed in the approach to these patients.

METHODS

Much of the data available on diseases in patients who have been to foreign destinations has been collected internationally by the

TABLE 1. Morphologic Pattern of Rashes

RASH OR LESION PATTERN	DESCRIPTION
Maculopapular/ morbilliform	Morbilliform or “maculopapular” eruptions are so named because they are measles-like. The classic pattern is one of erythematous macules and slightly elevated papules without other features—at least in the early stages—such as scale, crust, or deeper infiltration. It is the rash most typical of the nonspecific viral exanthem.
Papular	Papular rashes present typically with red, pink, or flesh-colored infiltrated papules. They can have a central punctum that can develop a crust. However, scale and crust are not primary features of these eruptions.
Polymorphous	An eruption that presents with multiple morphologies that may include dermatitis, papules, nodules, vesicles, and urticarial lesions and should be highly suspicious for scabies, particularly if pruritus is present.
Crusted papules	These lesions are red papules with mild to significant infiltration and a central crust or eschar. Patients can have few or many. Usually the infiltration and crusting are more significant than with minimally crusted grouped arthropod bites.
Plaques/nodules/ulcers	Most diseases that cause deep plaques or nodules can also present as ulcers (where the dermis has been breached and presents as an open or crusted wound). Nodular lesions are more deeply infiltrated than papular eruptions.
Papulosquamous	Lesions are papules or plaques that have associated scale. The degree of scale, pattern, adherence, and type of scale can vary broadly.
Vesiculobullous	Lesions are fluid filled, of the intraepidermis or subepidermis. They often rupture to form erosions (involves epidermis only) or ulcers (involves dermis).

TABLE 2. Top 10 Common Dermatologic Illnesses Encountered in the Returning Traveler

CAUMES ET AL (4)	FREEDMAN ET AL (5)	ANSART ET AL (6)	LEDERMAN ET AL (1)	HERBINGER ET AL (7)	LEDER ET AL (3)
Cutaneous larva migrans	Insect bite ± superinfection	Infectious cellulitis	Dog bite	Arthropod-related	Rabies after bite or scratch
Pyodermas	Cutaneous larva migrans	Scabies	Cutaneous larva migrans	Bacterial	Cutaneous larva migrans
Arthropod-related pruritic dermatitis	Allergic rash or reaction	Pruritus of unknown origin	Leishmaniasis	Helminthic	Leishmaniasis
Myiasis	Skin abscess	Pyoderma	Superinfected insect bite	Protozoan	Myiasis
Tungiasis	Superficial mycosis	Myiasis	Allergic rash	Viral	Tungiasis
Urticaria	Animal bite	Dermatophytosis	Superficial fungal infection	Allergic	Gnathostomiasis
Rash with fever	Leishmaniasis	Filariasis	Skin abscess	Fungal	Leprosy
Cutaneous leishmaniasis	Myiasis	Cutaneous larva migrans	Insect bite	Autoimmune	Cutaneous atypical mycobacteria
Scabies	Swimmer's itch	Urticaria	Dengue	Injury	Sporotrichosis
Injuries	Impetigo or erysipelas	Tungiasis		Phototoxic	Yaws

GeoSentinel Surveillance Network. Cutaneous diseases are the third most common group behind respiratory signs and symptoms, diarrhea, and fever in travel-related diseases. (1)(2)(3) Studies of the pediatric traveler are limited, although they compose part of the larger studies on diseases in returning travelers. Lederman et al (1) found that returning travelers with a dermatologic diagnosis had greater odds of being younger than 18 years. As such, data from broader populations are discussed herein.

We, therefore, determined a profile of common dermatologic problems in travelers, both tropical and cosmopolitan, from GeoSentinel data (Table 2).

SUGGESTED FRAMEWORK

There are potential pitfalls when assessing skin disease in the returning traveler. When a patient with a travel history presents with skin lesions or a rash, it is tempting to assume that an exotic infection was picked up during travel. This narrowed approach will often neglect many other possible—although perhaps more mundane—infections that can be acquired during travel. Travel may also be unrelated to an infection incubating before travel but presenting coincidentally with travel. A much broader approach to the patient's history will ensure attention to other diagnostic considerations. A second pitfall may be to ignore remote infectious exposures for which a latency period causes the skin disease to develop months or years after the exposure. One needs to take into consideration travel-related skin disease in such cases to appropriately acquire the patient's history.

Figure 1 presents a diagnostic framework with which to consider cutaneous disease in the returning traveler.

MORBILLIFORM RASH WITH FEVER

Travel-Related

Fever is rarely associated with skin findings. (1) However, fever and morbilliform rash in the returning traveler should alert the physician to consider arboviruses such as dengue and typhoid. Emerging entities to also consider are chikungunya and Zika viruses, and vaccine-preventable cosmopolitan illnesses such as measles.

Dengue fever (DF) is one of the most frequent causes of febrile illness among pediatric travelers returning from southeast Asia, Latin America, and the Caribbean. (3) It is transmitted to humans by the mosquito *Aedes aegypti*. There are 4 serotypes, and immunity after infection is distinct to the serotype. (8)

The incubation period of DF ranges from 3 to 14 days, with clinical features including retro-orbital pain, myalgia, arthralgia, and adenopathy. (8) Cutaneous manifestations are found in 50% to 82% of DF-positive cases but may vary in presentation among different age groups. (9) Transient flushing erythema of the face, neck, and chest occurs within the first 24 to 48 hours of fever. (8) Three to 5 days later, a generalized maculopapular rash appears resembling “white islands in a sea of red” as small islets of skin are spared. (8) This confluent rash starts on the extremities and moves centrally, tends to spare the

face, and is not usually associated with pruritus. (9) Hemorrhagic manifestations such as petechiae/purpura and a positive tourniquet test result may also be present (Fig 2). (10)

Diagnosis is with viral isolation, viral polymerase chain reaction (PCR) positivity, or paired serology (acute and convalescent-phase serum), and management is supportive with fluid therapy. Mosquito avoidance strategies can aid in prevention. (8)

Chikungunya is another *Aedes* mosquito-borne disease, most commonly reported in travelers returning from the Caribbean, particularly Haiti and south central Asia. (11)

With an incubation period ranging from 1 to 12 days, the infection presents with acute-onset fever, headache, arthralgia, lymphadenopathy, and a rash that is reported in 30% to 60% of children. (1) This skin eruption initially presents as a flushing erythema of the face, neck, and trunk, which then progresses into a generalized, nonpruritic, morbilliform rash with islands of spared skin 3 to 5 days later (Fig 3). (8)(10) Of note, the cutaneous manifestations of chikungunya vary across different age groups. The initial flushing of the skin has been followed by vesicubullous lesions in some infants. (12) Chikungunya fever is oftentimes hard to distinguish clinically from the initial stages of DF. (3) With that said, arthralgia is more severe in patients with chikungunya fever, whereas myalgia is the more prominent feature in DF. (13)

Laboratory diagnosis is through reverse transcriptase PCR (RT-PCR) and serologic testing; treatment is supportive, and mosquito avoidance is recommended. (12)

Zika virus infection is a major global health concern due to recent outbreaks in South and Central America, along with the Caribbean. (14)

It is transmitted to humans mainly through *A aegypti* mosquitoes. Zika virus has an incubation period of 3 to 12 days, and its clinical manifestations include arthralgia, non-purulent conjunctivitis, and headache. Skin findings are present in 90% of patients. (10)(14) Fever is mild if present. Along with hyperemic conjunctivitis, pruritic micropapular exanthema has been reported as a unique mucocutaneous finding in Zika virus infection. Skin eruption starts on the trunk and descends to the lower body. Petechiae are also found on the palate. (10)

Infection can be confirmed with RT-PCR, and treatment is supportive. (10)(14)

Typhoid fever is caused by the bacterium *Salmonella typhi*, which is shed in the stool during the illness and in asymptomatic carriers. It is transmitted through the fecal-oral route. Typhoid fever was found to be the most common cause of fever in children returning from Asia. (15)

The incubation period for *S typhi* can range from 3 to 60 days. (16) Clinical features are prolonged high fever, abdominal pain, and classic cutaneous "rose spots." These are

discrete pink and blanchable macules 2 to 4 mm in diameter appearing on the trunk and abdomen during the second week of the illness (Fig 4). These nonpruritic rose spots last 2 to 5 days and disappear without scarring. (17)(18)

Blood culture is the main diagnostic method. (16) Third-generation cephalosporins or azithromycin are first-line treatments. (19) Hand hygiene is one preventive strategy, and a vaccination is available, although its benefit may wane over time, necessitating a booster. (20)

Measles remains a major disease in developing countries and is increasingly reported in industrialized countries due to a decline in vaccination rates. (21) It is found mainly in Asia, as well as in Africa and Europe. Children who are not sufficiently vaccinated are at increased risk for contracting this viral illness. (21)

Measles virus is mainly transmitted by respiratory droplets and has an incubation period of 7 to 21 days. A classic tetrad of prodromal features includes cough, coryza, conjunctivitis, and Koplik spots. (21) Koplik spots are gray-white papules on an erythematous base and usually appear on the buccal mucosa (Fig 5). (22) A nonpruritic rash develops 2 to 4 days after the onset of symptoms. Erythematous macules and papules first appear on the face and descend toward the extremities, lasting 4 to 7 days (Fig 6). (21) The exanthem is around sebaceous glands and hair follicles and can be mildly hemorrhagic. Patients are infectious from 4 days before to 4 days after rash onset. (22)

Laboratory diagnosis is made through serologic testing and RT-PCR of the throat swab and urine. (23) In addition to treating measles symptomatically and treating the complications, there are some therapies that may be helpful. Vaccine administered within 72 hours of contact may limit disease development. The same is true of postexposure intramuscular immune serum globulin provided within 6 days of contact. This can be used for high-risk patients. Adjunct vitamin A treatment reduces blindness and death rates. (24)

Of note, the previously mentioned infections could present with a feverless exanthema, and the differential diagnosis of a patient with a morbilliform rash is essentially the same whether or not fever is present.

Non-Travel-Related

Drug eruption can be a non-travel-related cause of a maculopapular rash. It can be difficult to recognize exanthematous drug eruptions at times because many patients who have nonspecific infectious symptoms are given antibiotic drugs. Timing, reaction patterns, and other clinical findings can help differentiate drug eruptions from infectious causes. This is an important determination not only to make the correct diagnosis but also to prevent a patient from inappropriately being

labeled as having a drug allergy if in fact the rash is due to the infectious process. At times, an interaction between an infection and antibiotic drug treatment can produce an exanthema. Amoxicillin taken by a patient infected by Epstein-Barr virus is such an example (Fig 7). (25)

It is pertinent to remember, however, that drug eruptions can closely mimic various dermatoses and must be included in the differential diagnosis in any patient presenting with skin findings when medications have concomitantly been used.

Kawasaki disease (KD) is a vasculitis of childhood—as yet of unknown etiology. The diagnostic criteria include a fever lasting for at least 5 days and 4 of the following clinical findings: a polymorphous rash, conjunctivitis, cervical lymphadenopathy, oropharyngeal mucositis, erythema, and edema in the extremities. (26)(27)

A morbilliform eruption is the most common form of the exanthem, distributed over the trunk and extremities, including the perineal region, where early desquamation occurs (Fig 8). (26) Attention to the diagnostic criteria of KD should help distinguish it from a travel-related rash. KD is self-limited, but prompt administration of intravenous immunoglobulin helps reduce the risk of cardiac complications. (28)

PAPULAR ERUPTIONS

Travel-Related

Consistent throughout studies, 2 papular eruptions—cutaneous larva migrans and arthropod bites—were the most commonly reported travel-acquired dermatologic illnesses in children in addition to animal bites, although the latter would present as a wound and not as a papular eruption. (15)

Other conditions to consider in the differential diagnosis of papular eruptions include swimmer's itch and seabather's eruption.

Cutaneous larva migrans (CLM) is a skin infestation caused by larvae of the dog or cat hookworm, *Ancylostoma braziliense*. It is among the top dermatoses in the pediatric traveler returning typically from the Caribbean. It is also common in travelers of sub-Saharan Africa, south central Asia, and Central or South America. (5) Incidence of CLM is associated with direct skin exposure with contaminated soil on the beach or in a sandbox. (1)

CLM has a short incubation period of approximately 8 days. (4) The eruption initially presents with a local erythematous papule. The larvae remain in the epidermis and migrate, creating a linear, serpiginous rash that progresses at approximately 2 to 5 mm per day and is highly pruritic (Fig 9). The infestation is commonly seen on the distal legs, dorsa of the feet, buttocks, and hands. Less common morphologies include vesicular and follicular variants. Purulent discharge

may be seen, associated with secondary bacterial infections. (29)

Diagnosis of CLM is clinical, and although the eruption is self-resolving, it can be treated with albendazole in children.

(4) Pretravel counseling includes educating parents on strategies to prevent direct contact of skin with wet soil, such as protective footwear and use of towels. (30)

Arthropod-related eruptions can occur from mosquito, fly, flea, tick, mite, and lice bites acquired during travel to a broad range of regions.

Insect bites or stings can induce hypersensitivity reactions, or papular urticaria, and often occur in a single family member. (31) Lesions may present as small groups or linear papules, either discrete or widespread on exposed parts of the body. The urticarial papules may have a visible punctum that can crust with scratching. Arthropod bites are classically very pruritic. Secondary bacterial infection is common, and patients may present with signs of impetigo, cellulitis, and abscesses. (1)(31)

Lesions usually self-resolve, but antihistamines or topical corticosteroids can help with pruritus. Frequently they leave behind hypopigmented or hyperpigmented skin that ultimately resolves in most patients without treatment. Arthropod bites are important in travel medicine not only as agents of a pruritic rash but also as vectors for many travel-related diseases. Thus, prevention strategies, such as insect repellents and protective clothing, are critical. (31)

Lyme disease is a tick-borne infection caused by *Borrelia burgdorferi*. The bacteria-infected tick is prevalent in many areas of North America, Germany, and Italy. Therefore, history of exposure may not always include far away or exotic destinations. Regional excursions, camping, hiking, time spent in wooded areas, and similar activities should form part of a travel history. (3)

The incubation period can vary from 3 to 32 days after the tick bite. (32) The classic cutaneous manifestation of Lyme disease is erythema chronicum migrans and occurs early in the disease course. This localized lesion begins as a small erythematous papule at the site of the bite and enlarges in diameter, forming a uniformly homogenous annular lesion. While classically presenting as a target lesion with rings alternating with clearing, only a small number of lesions have central clearing (Fig 10). (32) In younger children, the lesions are more likely to occur on the head or neck, and in older children they occur more frequently on the arms and legs. (33) Disseminated disease can present with multiple lesions that appear over weeks. (33) Associated symptoms include low-grade fever, headache, myalgia, arthralgia, and fatigue. (32)

Diagnosis in the early stage should be clinical because serum antibodies against *B burgdorferi* may not be detectable

for 3 to 8 weeks after infection. A 2-tiered approach with screening and confirmatory serologic testing is used in late disease. (34) Early oral antibiotic drug therapy is highly effective, and prevention strategies include using tick repellants and avoiding tick-infested areas. (32)

Cercarial dermatitis (CD), or “swimmer’s itch,” is an inflammatory response to larval forms of avian schistosomes invading the skin. (35) It is common in temperate and tropical regions and can be seen after exposure to mostly freshwater but also brackish and marine habitats where aquatic snails release cercariae. (36) Freshwater CD is frequently reported in Asia, Africa, North America, and continental Europe. (35)

Despite the word *dermatitis*, this eruption typically presents as papules rather than as a dermatitis rash (Fig 11). The eruption is a type I hypersensitivity reaction where on re-exposure, highly pruritic and erythematous papules develop within 24 hours. Lesions may start as macules and are widely distributed in areas exposed to contaminated water. A systemic allergic reaction or Katayama fever can occur and is marked by pyrexia, diaphoresis, headache, eosinophilia, and urticaria. (36)

Although diagnosis of CD is clinical, evidence of ova in the urine or feces and serologic findings can provide confirmation. The condition self-resolves within 3 weeks, but antihistamines and topical corticosteroids may be used to treat symptoms. Avoiding shallow and stagnant water in hot weather is advised. (37)

Seabather’s eruption is a hypersensitivity reaction to the sting of the larvae of certain sea anemones found in marine waters. The stinging cells retained in fabric discharge toxin with mechanical pressure or change in osmotic pressure, such as post-swim rinse with fresh water. (38) This condition is commonly seen in Mexico, the Caribbean, Bermuda, and Florida. (39)

Within hours of exposure, a sensation of tingling occurs, which develops into a pruritic papular eruption. (38)(40) Compared with CD, papules are smaller in diameter. (39) The rash is distributed under swimwear, particularly in areas compressed against the skin, such as the abdomen, buttocks, breasts, and areas under bathing suit straps. The lesions can last 3 to 7 days. (38)

Diagnosis is mainly clinical. Treatment of the rash is symptomatic, and topical cortisones can help. Prompt removal of the bathing suit and patting skin dry may prevent reaction. (38)

Urticaria is a common eruption and may or may not be related to travel. Most cases are idiopathic or a reaction to a viral illness. Urticaria can also be seen as a reaction to a parasitic infection and, thus, should be considered in returning travelers. (4)

Urticaria presents as dermal wheals with a flare and can vary in size from tiny to giant (Fig 12). They can present as round papules/plaques or as annular and serpiginous lesions. They do not have scale or crust, and each lesion disappears within 24 to 48 hours, leaving behind no skin marking. (41)

If there are no other systemic features, such as fever or respiratory or gastrointestinal issues, to suggest infection, one should consider occult infections such as parasites. Therefore, testing a stool sample for ova and parasites might be indicated. (4) Specific lesions that last longer than 48 hours or leave behind skin changes or dyspigmentation should be considered urticarial rather than urticaria and may warrant further investigation, including skin biopsy. Although urticaria is self-limiting, antihistamines can aid in management. (41)

Erythema multiforme is considered a hypersensitivity reaction precipitated by infections or medications. The most common infectious cause is herpes simplex virus (HSV) infection, (42) and mycoplasma is known to cause a bullous erythema multiforme-like eruption. (43)

The characteristic clinical presentation is of erythematous papules that form fixed target lesions that have 3 zones of color change: outer red and pale rings surround a dusky center (Fig 13). (44) Lesions present in a symmetrical distribution, and there is a predilection for the palms and soles. Other symptoms include burning and mild pruritus. (41)

Diagnosis of this self-limiting lesion is clinical. Treatment includes topical corticosteroids, or systemic corticosteroids if lesions are widely distributed. (41) Herpes simplex, if present, can be treated with antiviral medications. If the target lesions are atypical or vesicular, in conjunction with mucosal erosions and crusts, consideration should be given to mycoplasma with appropriate diagnostic tests and antibiotic drug therapy.

Polymorphous light eruption is a reactive eruption occurring in sun-exposed areas. Although typically isolated, a small number of patients can have associated autoimmunity. (45) This papular eruption occurs usually at first exposure to sunlight in the spring or early summer or when there is travel to a sunny location. Although polymorphous light eruption is a self-limiting photodermatosis, topical corticosteroids and antihistamines can be used to reduce the inflammation, and application of sunscreen may help prevent its recurrence. (46)

Non-Travel-Related

Verrucae, or cutaneous warts, are caused by the human papillomavirus. The infection is spread through direct contact with skin or objects and is especially common in school-age children. (47) Lesions are few and localized, mostly on the hands, head, and neck. (48) They are also extremely common on the plantar surface. Characteristic papules are dome shaped and skin colored, with discrete margins. Hyperkeratosis gives these lesions a hard and rough texture. (49) Although warts often self-resolve within 2 years, topical therapies or localized physical interventions can be used in treatment. (48)

Endemic syphilis (bejel) is a rare, chronic, and nonvenereal bacterial disease caused by treponemal infection in dry climates. It can be transmitted through infectious household utensils and direct or indirect contact. Early lesions present as localized oral papules. (50) Papules, macules, mucous patches, and angular stomatitis are commonly present in moist body areas. (51) In the late stage of the disease, destruction of the nasal septum and palate can occur. (52) Clinical diagnosis is confirmed by serology, and antibiotics against *Treponema pallidum* are used in treatment. (51)

Papulonecrotic tuberculid is a rare hypersensitivity reaction to *Mycobacterium tuberculosis*.

Firm and dusky red papular eruptions are asymptomatic and symmetrical in distribution on the extensor surface of joints, acral areas of limbs, and ears. (53)(54) Lesions eventually undergo necrosis and heal with atrophic scarring. History in these patients is positive for tuberculosis contacts, Mantoux test, and previous or current tuberculosis. Histopathologic analysis aids in diagnosis, and the reaction responds to antituberculous therapy. (53)

POLYMORPHOUS ERUPTIONS

Scabies is a hypersensitivity reaction to the mite *Sarcoptes scabiei* burrowing into the epidermis. (55) The infestation is mainly transmitted through skin-skin contact, which explains its high prevalence in developing countries and orphanages. The highest incidence rates are seen in tropical regions of east Asia, southeast Asia, Oceania, and Latin America. (56)

Onset of symptoms after primary infestation is 4 to 6 weeks. (55) Pruritic nocturnal and familial eruptions are often found on history. (57) However, because the pruritus and rash are manifestations of the host response to the scabetic infestation, the absence of those features is not sufficient to exclude the diagnosis in close contacts. Hence, asymptomatic close contacts should be treated as well. Although serpiginous or linear burrows are pathognomonic for scabies, papulonodules, papulopustules, dermatitis, and vesicles can also occur (Fig 14). (57) Lesions are more commonly seen on the palms and soles in younger children, and they are more widespread and excoriated in older children. (57)

On microscopic examination of skin scrapings, identification of mites, eggs, or fecal pellets is diagnostic. (58) Permethrin is the treatment of choice for scabies. (55)

CRUSTED PAPULAR ERUPTIONS

Travel-Related

Bacterial skin infections are a major cosmopolitan cause of dermatoses. Pyoderma is commonly seen in most of the series reported in the literature. (4)(6) Infections include

impetigo, ecthyma, or erysipelas. Insect bites or stings are frequently found to be the inciting event leading to an infection, along with other cutaneous trauma acting as portals of infection. (4)(6) In particular, children younger than 18 years are more likely to develop superinfected insect bites. (1)

Impetigo is a superficial bacterial skin infection, of which nonbullous impetigo is the predominant type. Impetigo is primarily caused by *Streptococcus pyogenes* or *Staphylococcus aureus*. Lesions are distributed on the face and extremities. Initial vesicles and pustules rupture and turn into a characteristic honey-colored crusted plaque. (59)

Culture and sensitivity testing are recommended to aid in the diagnosis and treatment of resistant strains. (59) Pre-travel advice should include options for self-treatment of early lesions, such as topical and oral antibiotic agents. (1)

Cutaneous myiasis is caused by the larvae of African tumbu fly *Cordylobia anthropophaga*, found in tropical Africa, and human botfly *Dermatobia hominis*, found in South and Central America. (60) It is frequently reported in travelers returning from Belize, Bolivia, and Costa Rica. (1)

Clinical symptoms are related to the larval life cycle and range from mild pruritus to severe pain, agitation, and insomnia. Furuncles with central punctum are surrounded by erythematous and edematous skin, which is tender to touch. (61) Serous discharge and sensation of movement under the skin are also described. (60)

Cutaneous myiasis is self-limited as larvae mature and emerge in 8 to 20 days. However, the larvae are usually extracted to prevent secondary infections. Before removal, occlusive substances such as petroleum can be applied to the lesions to block larval air exchange and induce asphyxiation. Use of repellents and mosquito nets is recommended to avoid bites. (60)

Tungiasis is caused by the epidermal burrowing of the female sand flea, *Tunga penetrans*. It can be seen in those with travel to Central and South America, sub-Saharan Africa, India, and Pakistan. (62) Poor hygiene and contact with domestic animals in endemic countries have been responsible for its transmission.

As the infestation at the site of penetration grows, an erythematous nodule with a black central punctum and a surrounding white halo is observed. (63)(64) There may be egg or serosanguineous fluid discharge. (62) Lesions are found on the hands, buttocks, genitals, and, most commonly, feet. These distributions are associated with the behavior of children walking barefoot and sitting unclothed in sand. (64) Superinfections are common and may present with pustules, ulcerations, and suppuration. (63)

Lesions self-resolve, but the sand flea can be removed with a sterile needle. Broad spectrum antibiotic drugs are

used for bacterial superinfection, and tetanus prophylaxis is recommended. (62)(63) Use of insect repellants, adequate clothing, and footwear is recommended while traveling in endemic areas. (62)(63)(64)

Non-Travel-Related

Picker's papules are common lesions presenting as 1 or several crusted papules. These occur in patients who tend to pick at their skin, either as a reaction to stress or as habit. Often there is an originating lesion that starts the process and the patient then continuously picks off the crust each time it forms, creating an excoriated infiltrated papule.

PLAQUES/NODULES/ULCERS

Travel-Related

Leishmaniasis is caused by the *Leishmania* protozoan parasite, transmitted by sandflies. Rodents and canines are the reservoir for the parasite, with humans as the accidental host. The 2 major types of leishmaniasis include Old World and New World cutaneous leishmaniasis (CL) and visceral leishmaniasis. Old World CL is acquired in sub-Saharan and northern Africa, the Mediterranean basin, the Middle East, southern Asia, and China. New World CL is commonly seen in travelers of South and Central America. (65)(66)

With an incubation period ranging from weeks to months, CL initially manifests as papules on exposed sites, evolving into nodules, and finally painless crusted ulcers with raised borders (Fig 15). Lesions are usually 0.5 to 8 cm in diameter. (67) Secondary infections and painful ulceration may occur once the crust is sloughed off (Fig 16). (68) These lesions can last for months to years, and although they may self-resolve, it is often with scarring. (69) Infection with New World CL may lead to mucosal lesions of the nose and mouth, appearing long after the cutaneous lesions have healed. (69) A common site for this complication is the cartilaginous septum, and it may be accompanied by erythema, secretions, pain, and epistaxis. (68)(69) Of note, leishmaniasis recidivans refers to recurrent lesions at the original site. Post-kala-azar dermal leishmaniasis are skin lesions that develop years after the primary visceral infection is treated. (67)

Diagnosis of CL is confirmed with skin biopsy, dermal scraping, or fine needle aspirate. PCR provides a rapid and more sensitive and specific tool in diagnosis. (70) Old World CL is typically self-limiting, and treatment for New World CL is recommended to prevent dermal and mucosal spread. Standard therapy includes antimonial agents and pentamidine. (65) CL can be prevented through appropriate use of

insect repellants and insecticides while traveling in endemic areas.

Leprosy is a stigmatizing, deforming disease caused by *Mycobacterium leprae*. This bacterium tends to live in the skin, the superficial nerves, and tissues with lower temperature. Transmission of leprosy is through close or intimate contact via nasal and oral droplets, and its contractibility may depend on genetic susceptibility. (71) The incidence is higher in patients born and raised in endemic areas versus in travelers. (2)

Incubation takes months to years, and the disease can progress, stay limited, or resolve depending on the cell-mediated immune response. In children, manifestation of leprosy is different than in adults. Indeterminate and tuberculoid leprosy, the milder forms, are the most common variants. (71)(72) Indeterminate leprosy manifests as ill-defined, hypopigmented macules or plaques (Fig 17). (71) The presentation of tuberculoid leprosy is with well-demarcated red or white plaques. Lesions in children often occur on exposed parts of the skin, and single lesions are more common than multiple ones. (71) Neural and systemic symptoms in this age group are found to be less common. (71)

Diagnosis is mainly clinical by skin and neurologic examination, taking into consideration a detailed patient history and living conditions. (72) Skin biopsy and a skin smear test can be used as confirmatory tests. In clinically suspicious cases with no conclusive skin smear or histopathologic findings, tissue PCR may help detect the bacteria. (73) Early diagnosis is imperative to prevent secondary disabilities and disfigurement. Multidrug therapy for many months leads to cure. (72)

Non-Travel-Related

Yaws is a nonvenereal treponemal disease endemic in tropical regions, commonly affecting children younger than 15 years, and is spread by direct skin contact of infectious lesions. (74) Yaws occurs in 3 stages, with latent intervals in between. Three to 4 weeks after infection, a primary "mother yaw" lesion appears at the site of inoculation, ulceropapillomatous in appearance. Secondary disseminated lesions follow, and in some, the third stage of the disease occurs years later with destructive lesions of the skin, bone, and joints. (74)(75) Diagnosis of yaws is also through the combination of clinical picture and serologic testing, and patients are treated with antibiotic drugs against *T pallidum*. (75)

Furthermore, there are many causes of nodules and ulcers in children that are noninfectious and may or may not be related to travel, including foreign body granuloma, injury, pyoderma gangrenosum, sarcoidosis, and, rarely, lymphoma.

PAPULOSQUAMOUS

There are several cosmopolitan infections that present with papulosquamous eruptions but could easily occur coincidentally in a traveler.

Tinea infections such as tinea capitis and tinea corporis are among the most common dermatophytoses seen in children. These fungal infections are transmitted through direct contact with infected humans and animals. Factors such as poor hygiene and crowded spaces perpetuate their spread. (76) Colonization by dermatophytes due to absent sebum explains the high prevalence of tinea capitis in children. (76)

Tinea corporis usually presents with lesions that start as small scaly papules that grow centrifugally. These annular eruptions have a leading scaly edge and a center that clears as the lesion expands (Fig 18). Diagnosis is usually clinical, although fungal scrapings for potassium hydroxide examination and culture may aid in the diagnosis. Treatment is with topical antifungal agents. (76)

Tinea capitis has varied clinical presentations that include erythematous, scaly patches on the scalp and may include alopecia (Fig 19). Lymphadenopathy may also be present in patients with tinea capitis, often in the posterior cervical and auricular chains. (77) Diagnosis of tinea capitis should be confirmed by potassium hydroxide examination and mycologic culture of epidermal scrapings because it can be difficult to tell apart from psoriasis, seborrheic dermatitis, and atopic dermatitis of the scalp. Oral antifungal drug therapy is indicated for treatment. (76)

Exacerbations of underlying dermatoses such as atopic dermatitis or psoriasis can occur from environmental exposures. For example, humid environment during travel may cause flaring of atopic dermatitis. Psoriasis in a patient who lives year-round in a sunny area may flare if he or she spends an extended time in a place with less sunlight. As well, many patients who immigrate to another country will uncover an underlying skin disease for which they were genetically prone but presented only in a particular climate.

Non-Travel-Related

Pityriasis rosea (PR) is an acute self-limited eruption thought to be caused by human herpesvirus-6 or human herpesvirus-7 reactivation. PR is more likely to occur in the second and third decades of life and is less common in children younger than 10 years. There are a few differences in its presentation in children that should be noted. (78)

PR classically presents with an initial herald patch, a scaly erythematous plaque 2 to 6 cm in diameter. It is often mistaken for tinea corporis, but it fails to resolve with antifungal drug therapy and is usually followed by a

generalized eruption that occurs much faster in children and is shorter in duration. (78) The eruption has a predilection for the trunk and presents as thin papules with a collarette of scale often lined up in a pattern resembling the branches of a Christmas tree (Fig 20). Oral lesions are also more common in children. (78)

Diagnosis is typically clinical, although occasionally biopsy is needed to distinguish it from other entities. Although PR is self-limiting, treatment is indicated if needed for pruritus. Topical corticosteroids or oral macrolides (for their anti-inflammatory effects) can be helpful (C. Villarama, MD, P. Lansang, MD, unpublished data, 2002). (79)

VESICULOBULLOUS

Travel-Related

Allergic contact dermatitis (ACD), a type IV hypersensitivity reaction, can be plant-based, such as seen with poison ivy, poison oak, or poison sumac. Plant-based ACD typically presents as a vesiculobullous eruption, whereas ACD to other topical agents often presents as a dermatitis. In sensitized individuals, direct or indirect contact with urushiol, the active allergen, may result in an eruption. The initial linear erythematous lesion gives way to pruritic vesicles and bullae 12 to 48 hours after exposure. Severe edema can result. History of contact exposure is important in diagnosis, and although lesions are self-limiting, antihistamines and corticosteroids can be used depending on severity. (80) Patch testing can help distinguish ACD from other types of similar dermatoses. (81)

Phytophotodermatitis is a phototoxic eruption caused by skin exposure to plant-based photosensitizing agents and subsequent UV-A exposure. Limes are most often implicated, along with celery, carrot, or parsley. Within 24 to 72 hours after exposure, irregular, well-demarcated erythematous lesions appear that may be accompanied by vesicles or bullae. Pigmented macules and patches mark post-inflammatory hyperpigmentation. Although lesions are self-resolving, topical corticosteroids may be used to accelerate healing. (82)(83)

Other noninfectious causes of vesiculobullous lesions to keep in mind in the returning traveler are sunburns, thermal burns, and phototoxic reactions to medications such as doxycycline. Superficial injuries such as sunburns are more likely to be diagnosed during the patient's travel rather than afterward. (4)

HSV infects mucosal and cutaneous surfaces and persists in regional sensory nerve ganglia in a latent state. Activation causes recurrent lesions in the region, and, importantly, HSV labialis can be induced by sun or stress. Therefore, this diagnosis should be kept in mind in the returning traveler.

Non-Travel-Related

Bullous impetigo is commonly seen in children between the ages of 2 to 5 years and is usually caused by the exotoxin of some strains of *S aureus*. Bullous impetigo presents as flaccid blisters and bullae less than 3 cm in diameter that often rupture rapidly; the bullous stage may be missed. At times, the collarette of the ruptured bulla can be seen at the edge of the lesion with a large eroded or crusted area in the collarette. (84) These lesions occur on the face, trunk, buttocks, perineum, and extremities. The source of infection in bullous impetigo is usually in the bullous lesion itself, where bacteria can be cultured. Topical and oral antibiotic drugs are used for treatment. (85)

Hand, foot, and mouth disease (HFMD) is caused by coxsackieviruses and is spread through the oral-fecal route, respiratory secretions, or vesicular contact. (86) Epidemics are seen in Asia, Europe, and the United States, commonly in child care centers and in school-age children. Outbreaks mostly occur in spring and summer months. (87)

The incubation period of this viral illness is 3 to 7 days, (88) and early manifestations include fever, gastrointestinal symptoms, and painful oral mucosa vesicles and erosions. (86)(89) The subsequent erythematous papulovesicular lesions are found diffusely on the hands, feet, and buttocks in isolation or in groups (Fig 21). (90) Coxsackievirus-associated HFMD can be extensive and severe in patients with atopic dermatitis, lending itself to the term *eczema coxsackium*, or can appear in areas of previous trauma and inflammation. (86)

Diagnosis is clinical, and the course of HFMD is usually mild and self-limiting, with treatment being mainly supportive measures. (90)

Immunobullous diseases are caused by autoantibodies that target the cutaneous basement membrane, resulting in sub-epidermal blistering. In the younger demographic, the most common form is chronic bullous disease of childhood, which presents as disseminated clusters of tense bullous lesions filled with clear or hemorrhagic fluid resembling a "string of pearls" (Fig 22). New lesions often arise on the periphery of previous lesions and may be pruritic. Diagnosis is made through histology with immunofluorescence, and oral dapsone or sulfapyridine is the suggested treatment. (91)

Fixed drug eruptions are an uncommon adverse cutaneous drug reaction. Bullous fixed drug eruption is one variant where recurrent lesions occur at identical sites hours after use of the offending drug, often antibiotics, anticonvulsants, and analgesics. The trunk, lips, hands, and genital mucosa are most commonly affected. Deep hyperpigmentation marks the site of eruption once the inflammation has subsided (Fig 23). Clinical diagnosis relies on history, and the causative agent is identified to prevent recurrence. (92)(93)

RESOURCE FOR PARENTS

Choosing an Insect Repellent for Your Child - <https://www.healthychildren.org/English/safety-prevention/at-plau?Pages/Insect-Repellents.aspx>

Summary

- In the pediatric traveler, the morphology of a given skin lesion or rash, more so than the exotic location of travel, is an excellent starting point in developing a differential diagnosis.
- The location of travel in the approach to a rash, although important at determining specific exposures, can at times be a false lead. In the diagnostic evaluation, it is imperative to also consider cosmopolitan exposures, irritants, medications and vaccinations, latent infections, and preexisting skin conditions.
- On the basis of class B evidence, cutaneous larva migrans and arthropod-related skin disease are the 2 most common acquired dermatoses in the traveling child. In both conditions, and other less common conditions, the exposed skin is a key risk factor. (1)
- On the basis of class D evidence, clothing, closed footwear, and insect repellents should be advised for travel, along with sun protection. (30)
- On the basis of class D evidence, insect repellents are imperative in pretravel counseling given the burden of disease related to arthropods, including bites, secondary infection, and diseases carried by arthropod vectors. (1)
- On the basis of class D evidence, rarer and more exotic entities, such as endemic syphilis, papulonecrotic tuberculid, leishmaniasis, leprosy, and yaws, cause destructive lesions, and early diagnosis is imperative to prevent complications. (53)(65)(72)(75)

To view teaching slides that accompany this article, visit <http://pedsinreview.aappublications.org/content/41/4/184.supplemental>.

Where in the World Did You Get That Rash?

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1. You are evaluating a 14-year-old girl who returned 7 days earlier from a trip to Venezuela where she was spending spring break week with a native family on a school exchange program. She reports retro-orbital pain, myalgia, and arthralgia. On physical examination her temperature is 102°F (38.9°C). Skin examination shows a generalized maculopapular confluent rash that, according to her, started on her extremities and moved centrally. The rash is nonpruritic. You suspect dengue fever. Which of the following additional findings is consistent with this possible diagnosis in this patient?
 - A. A spreading to affect the face in the next 3 to 4 days is pathognomonic.
 - B. Hemorrhagic manifestations such as petechiae/purpura rule out the diagnosis.
 - C. Negative tourniquet test result.
 - D. Oral antiviral agent is the treatment of choice.
 - E. Positive polymerase chain reaction confirms the diagnosis.
2. You are working in the university-sponsored immigration clinic. An Asian family that recently arrived in the United States presents to the clinic with their 8-year-old son who has had a "high fever" and abdominal pain for the past week. On physical examination his temperature is 104°F (40.0°C). Small (2–4 mm in diameter) pink blanching macules are noted on the trunk and abdomen. The rash appears to be nonpruritic. The remainder of the physical examination findings are normal, with no signs of conjunctivitis or arthralgias. Which of the following is the most likely diagnosis in this patient?
 - A. Chikungunya.
 - B. Dengue fever.
 - C. Rotavirus infection.
 - D. Typhoid fever.
 - E. Zika virus infection.
3. A 3-year-old boy who immigrated to the United States 2 weeks ago from England is brought to the clinic by his parents because of a history of intermittent fevers, with temperatures up to 102°F (38.9°C) for the past 5 to 7 days. The parents also noted that his eyes are red. On physical examination he is noted to have conjunctivitis, edema of the extremities, cervical lymphadenopathy, and a polymorphous blanching rash. In discussing the most likely diagnosis with the family, which of the following is the most accurate statement about this clinical condition in this patient?
 - A. Handwashing can prevent spread of the illness.
 - B. Intravenous immunoglobulin therapy can help reduce the risk of cardiac complications.
 - C. Polymerase chain reaction is used to confirm the diagnosis.
 - D. The causative agent can be isolated by viral culture.
 - E. The rash is likely related to travel.
4. A 14-year-old male adolescent is seen in the travel clinic. He presents with painless papules, nodules, and crusted ulcers on his face, some of which are 0.5 cm in diameter with raised borders. He reports that he returned a month ago from a trip to South America where he visited with relatives. A diagnosis of leishmaniasis is suspected. In counseling the patient, which of the following is the most accurate statement about this clinical condition?
 - A. Chemoprophylaxis before traveling next time to endemic areas is advisable.
 - B. Diagnosis is made by antibody titers.
 - C. Spread to the gastrointestinal tract is common.
 - D. Standard treatment includes antimonial agents and pentamidine.
 - E. This condition is self-limiting.

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5. A 15-month-old girl is brought to the clinic by her parents because of a rash on her scalp. No history of associated fever. On physical examination patches of erythematous scaly papules are noted on the scalp with a scaling center. Some of the patches show alopecia and broken hair shafts. Neck examination showed mildly enlarged posterior cervical and auricular lymph nodes, movable, nontender, with no warmth or overlying skin erythema. Which of the following is the most appropriate next step in the management in this patient?
- A. Oral antibiotic drug therapy.
 - B. Oral antifungal drug therapy.
 - C. Oral corticosteroid therapy.
 - D. Topical antifungal drug therapy.
 - E. Topical permethrin therapy.

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Pediatrics in Review 2020;41;184

DOI: 10.1542/pir.2018-0200

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