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## Sleep Tight, and Don't Let the Ectoparasites Bite: Part 1

*Providers in the pediatric emergency department frequently encounter ectoparasitic infestations. Lice and scabies require early recognition and knowledge of effective treatment strategies. This month, the author reviews scabies, chiggers, and lice. Next month, the bed bugs and ticks will come biting!*

— Ann M. Dietrich, MD, FAAP, FACEP, Editor

Many contagious ailments seen in the pediatric emergency department arise from the phenomenon of parasitism, in which one organism derives nutritional benefit to the detriment of another. Generally speaking, this phenomenon is the basis of all infectious diseases, from a strain of coronavirus replicating in the mucosa of the upper respiratory tract, to a *Staphylococcus aureus* bloodstream infection.

However, ectoparasites generally are distinguished from other parasitic infectious agents by their size and preferred host habitat. As opposed to the many viral and bacterial causes of disease in humans, all medically significant ectoparasites are arthropods that infest and feed directly on the human host at the level of the epidermal or dermal strata in the skin or on related structures, such as hair and sebaceous glands, as well as external orifices like the ears, nares, and orbits.<sup>1</sup>

Although this definition broadly includes many medically significant arthropod-human interactions, this review will focus on those infestations that are most likely to present diagnostic and therapeutic challenges to the practitioner in the pediatric emergency department. This review discusses the epidemiology, life cycle, clinical manifestations, diagnostic considerations, and treatment options for scabies, mites, and lice.

### Scabies

#### Description and Epidemiology

There are many medically significant species of mites, including scabies mites (*Sarcoptes scabiei*), trombiculid or chigger mites, hair follicle and sebaceous gland mites, dust mites, and a wide variety of other species that infest plants, wood, and animals.

Scabies is a global disease, with upwards of 300 million cases estimated annually.<sup>2</sup> While any human host is at risk for scabies infestation based on contacts and risk factors, endemic infestations are noted particularly in socioeconomically impoverished communities, with hyperendemic foci in the developing world.<sup>3,4</sup> Outbreaks in nosocomial and institutional settings also are an important epidemiologic consideration.<sup>5-9</sup> Some have noted that infestations are more common in urban populations during the winter, likely due to crowding.<sup>10</sup> Uniquely, scabies infestations are found more

## EXECUTIVE SUMMARY

- The average case of scabies is characterized by an infestation of only one to 15 adult mites. Although scabies is contagious, transmission generally requires close contact between hosts, and is seen most often between those who live in close association or share bedding.
- The typical clinical manifestation arises four to six weeks after initial contact with scabies mites and consists of the classic eruption of intensely pruritic papules, vesicles, pustules, and pathognomonic linear burrowing tracts.
- Patients may present after treatment with secondary rashes, consisting of papules and pustules predominantly on the hands and feet, accompanied by intense itching. These may represent a reaction to deceased mites lodged in burrows in the skin after successful treatment.
- Crusted scabies is a particularly severe manifestation of *Sarcoptes scabiei* infestations. Those at epidemiologic risk are immunocompromised patients.
- Permethrin 5% cream generally constitutes first-line treatment for scabies infestations, and should have good scabicial and ovicidal action against mites and their eggs. Each application should cover the child's body below the head, and should be removed by bathing after eight to 14 hours. Treatment should be applied to the scalp, face, and neck in infants and younger children because of the nature of more widely disseminated infestations in this age group. A second treatment should be applied one week later.
- Warm, humid regions are noted to have a high prevalence of chigger infestations, most commonly caused by the American chigger mite (*Eutrombicula alfreddugesi*).
- Bites from chiggers and other mites should be treated symptomatically, since the arthropods typically drop off the host after feeding and do not constitute an ongoing infestation. These may be treated with oral antihistamines and topical corticosteroids.
- The most common manifestation of louse infestations is pruritus due to the irritation of injected saliva during feeding behavior. Infestations of head lice may manifest with irritation, excoriation, and local inflammation, with secondary bacterial infection and the development of pustules, crusting, and posterior cervical lymphadenopathy.
- For head lice, over-the-counter 1% permethrin lotion or pyrethrin combined with piperonyl butoxide generally are used as first-line treatments. Treatment should be repeated seven to 10 days later to kill lice hatched from eggs present during the first course. Second-line therapy uses malathion, benzyl alcohol lotion, spinosad suspension, or ivermectin lotion, or, in children weighing more than 15 kg, oral ivermectin.

commonly in children and adolescents, which is attributed to increased exposure and contact with infested peers.<sup>11</sup>

Crusted or "Norwegian" scabies is a particularly severe manifestation of *S. scabiei* infestations. Those at epidemiologic risk are immunocompromised patients, particularly those with HIV and HTLV-1, as well as those with chronic alcohol use, poorly controlled diabetes mellitus, and immunosuppression in the context of solid organ transplant.<sup>12,13</sup> However, reports exist of immunocompetent children and adults with the disease.<sup>12,14-16</sup> Patients with crusted scabies often may be pinpointed as index cases in institutional outbreaks.<sup>5</sup>

### Life Cycle and Pathophysiology

Unlike ticks and many other ectoparasites, mites do not feed on the host's blood, but rather on pooled lymph and tissue juices obtained by injecting cell-dissolving saliva into the skin.<sup>17</sup> Female scabies mites are just visible without the aid of microscopy. The female scabies mite is white and disc-shaped, measuring approximately 0.30 mm to 0.45 mm, while the male

is smaller at 0.2 mm to 0.35 mm long.<sup>18</sup> (See *Figure 1*.) Both males and females infest a host. However, females more typically burrow and eat their way into the stratum corneum of human skin, and males more typically spend much of their lives wandering the surface of the skin. After mating, female scabies mites may lay one to three eggs per day in tunnels in the superficial layers of the skin. From these eggs emerge mite larvae, which progress through a moulting process and nymphal stages to become adults. Without a host, scabies mites only survive two to five days.

The average case of scabies is characterized by an infestation of only one to 15 adult mites. Although scabies is contagious, transmission generally requires close contact between hosts, and is seen most often between those who live in close association or share bedding. The transfer of mites from one individual to another may take at least 15 minutes of close contact. Because of the limited survival of mites away from their hosts and the nature of the infestation in or on the skin itself, indirect transmission through discarded clothing is rare.

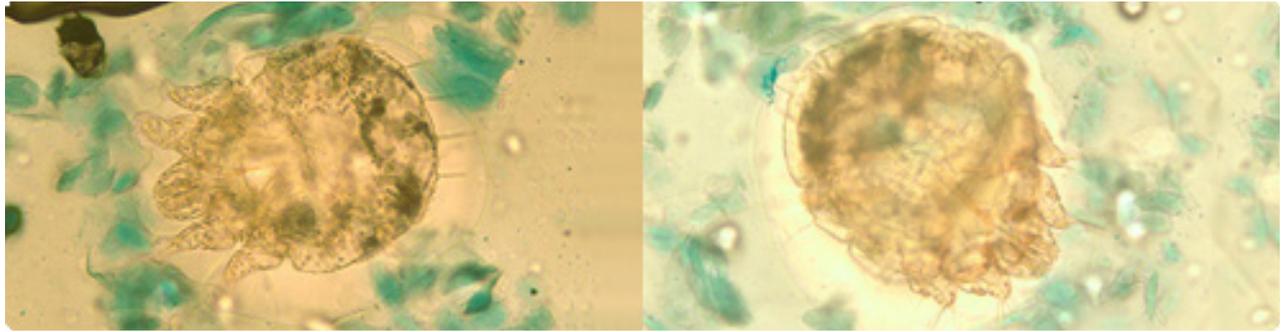
### Clinical Manifestations and Diagnosis

After initial contact with scabies mites, the typical clinical manifestation arises after four to six weeks and consists of the classic eruption of intensely pruritic papules, vesicles, pustules, and pathognomonic linear burrowing tracts.<sup>18</sup> These may be found in regions in which scabies mites most frequently infest the stratum corneum, such as areas where the skin is thin and densely featured with wrinkles.<sup>19</sup> In older children and adults, these areas include finger and toe webs, wrists, feet, penis, scrotum, buttocks, axillae, beneath the breasts, and occasionally in the postauricular folds. (See *Figure 2*.) In infants, the eruption may be more intense, with a markedly different distribution including the head, neck, trunk, palms, soles, and dorsal and lateral aspects of the feet,<sup>20</sup> a pattern of lesions which some practitioners endearingly call by the colloquial name, "baby scabies."

In daily practice, most providers choose to diagnose scabies infestations based on the clinical history and exam alone. In some situations, direct

## Figure 1. *Sarcoptes scabiei*

*Sarcoptes scabiei* mites in a skin scraping, stained with lactophenol cotton-blue



Source: Centers for Disease Control and Prevention. DPDx - Laboratory Identification of Parasites of Public Health Concern.

evidence of scabies infestation may be revealed by the tunneling behavior of the female mites. Mite feces within the tunnels may be noted as small, pepper-like dark spots.<sup>18</sup> However, detection of tunnels typically is difficult, especially in individuals with darker skin. Several methods may be employed to elucidate their course. A drop of ink may be applied to areas of suspected infestation, and, after allowing several minutes for the ink to seep into the tunnels, it may be wiped clear to reveal the tracts.<sup>19</sup> Similarly, liquid tetracycline can be applied to make these tunnels fluoresce under ultraviolet light.<sup>18</sup> Finally, the practitioner may scrape the affected areas with a scalpel or razor and examine the scrapings with a light microscope with a potassium hydroxide mount, thereby viewing the *Sarcoptes* mite directly, although the clinical yield of this practice is uncertain.<sup>19</sup> Adhesive tape pressed on affected areas and then examined under a light microscope also may be used for a faster, albeit likely less sensitive, technique.<sup>19</sup>

Patients may present after treatment with secondary rashes, consisting of papules and pustules predominantly on the hands and feet, accompanied by intense itching.<sup>19</sup> These may represent a reaction to deceased mites lodged in burrows in the skin after successful treatment.

More rarely, intense *Sarcoptes* superinfestations in immunocompromised, elderly, and debilitated individuals

may give rise to the phenomenon of Norwegian crusted scabies.<sup>12</sup> Dense accumulations of mites and eggs may give rise to thickened, hyperkeratotic crusts, frequently on the feet or hands, although other regions may be affected as well. Depending on the host, itching may or may not be present. When encountering pediatric patients with this diagnosis, practitioners should inquire about the presence of immunodeficiency, corticosteroid use, or neglect.

### Treatment

Permethrin 5% cream generally constitutes first-line treatment for scabies infestations, and should have good scabicial and ovicidal action against mites and their eggs.<sup>21</sup> Each application should cover the child's body below the head, and should be removed by bathing after eight to 14 hours. Treatment should be applied to the scalp, face, and neck in infants and younger children because of the nature of more widely disseminated infestations in this age group. For all children and adults, a second treatment should be applied one week later. Families should consider treating all household members, even in the absence of symptoms in certain individuals, since not all family members may experience lesions even in the presence of active infestation. Patients and families also should take care to launder their clothing and bed sheets to prevent the (albeit unlikely) possibility of fomite transmission.

Oral ivermectin is an alternative option for those who cannot tolerate topical permethrin or who have failed treatment due to inadequate topical application or other reasons.<sup>21</sup> However, ivermectin generally is less effective than topical permethrin. Importantly, ivermectin is not ovicidal, and should be given as two doses seven to 14 days apart to kill newly hatched mites.

Further alternative treatments for scabies infestations include 10% crotamiton cream or 5-10% precipitated sulfur compounded into petrolatum, although these may be more difficult to obtain routinely in the emergency department or urgent care setting.<sup>21</sup>

Patients may continue to experience itching and lesions for several weeks after effective treatment because of the presence of killed scabies mites and their eggs.<sup>19</sup> This phenomenon may explain the frequency with which patients appear to "fail" treatment. For those who continue to experience skin lesions after effective treatment, this hypersensitivity response can be moderated with the use of oral antihistamines and topical corticosteroids. However, some family members may have an active infestation without lesions and, without treatment, inadvertently may lead to reinfesting their cohabitants.<sup>18</sup>

### Chiggers and Other Mites Description and Epidemiology

"Chigger" mites in the family *Trombiculidae* are found most

## Figure 2. Scabies Rash

Day 8 of scabies on right hand, wrist, and arm. Many itchy red spots are visible. The skin was coated with a pesticide lotion. Antihistamines were taken in the form of pills.



Source: Wikimedia Commons / Public Domain.

commonly in damp, grassy regions, particularly the margins of wooded areas, and they appear to be most active in summer and early autumn.<sup>22</sup> In North America, warm, humid regions, such as the Southeastern United States, are noted to have a high prevalence of infestations, most commonly caused by the American chigger mite (*Eutrombicula alfreddugesi*).<sup>17</sup> In certain regions of tropical South and Southeast Asia, East Asia, and Northern Australia, chigger infestations may transmit scrub typhus (*Orientia tsutsugamushi*), which may infect nearly 1 million people annually.<sup>23</sup> (See Figure 3.)

Numerous other species of mites abound in households and among human populations. Besides scabies mites, the only other mites found exclusively on human hosts include the relatively benign commensal *Demodex* spp., which inhabit human hair follicles and sebaceous glands.<sup>17</sup> Clinically relevant household mites include such species as

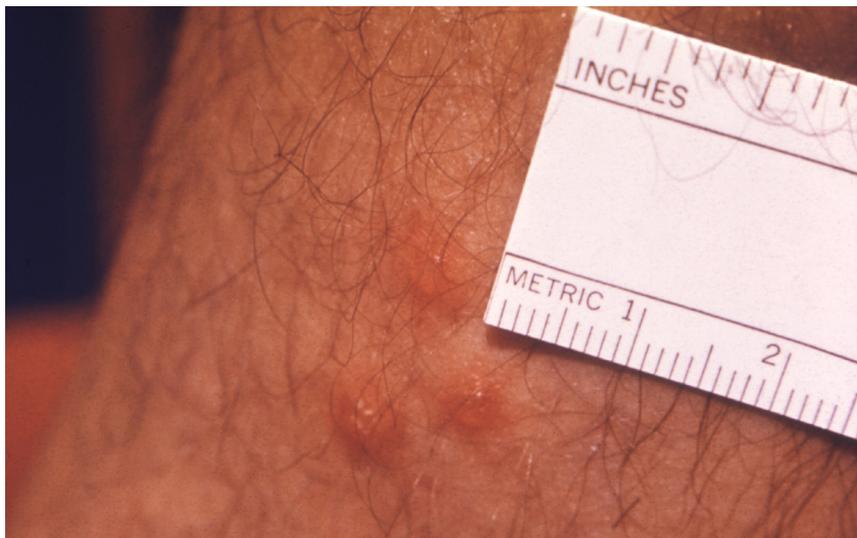
## Figure 3. Chigger (*Trombicula autumnalis*)



Source: © Tib124 / Wikimedia Commons / CC-BY-SA-3.0 / GFDL

## Figure 4. Chigger Rash

This image depicts three erythematous chigger bites on a patient's arm. Note the red welt or blister-like appearance at each of the three bite sites. Each welt measures approximately 3-4 mm in diameter.



Source: Centers for Disease Control and Prevention.

## Figure 5. Trombiculosis Sores

Trombiculosis sores from chigger bites on human ankle skin



Source: Mark A. Wilson / Wikimedia Commons / Public Domain.

*Dermatophagoides* spp., which live in human bedrooms and bedding year-round, and may trigger dermatologic and immunologic reactions and rashes via discarded allergenic material from dead mites.<sup>18</sup>

Mites from other host species, such as poultry, pet birds, rats, mice, and cats, occasionally may bite humans if the circumstances permit.<sup>17</sup> Likewise, various other mite species from habitats formed by leaves, vegetation, bark, wood, and straw also may attach themselves to human hosts opportunistically, depending on the exposure and occupational risk factors.

### Life Cycle and Pathophysiology

Female chigger mites and other members of the *Trombiculidae* family deposit their eggs on the ground or nearby vegetation and may be found clustering in "mite islands" of brush or grass.<sup>18</sup> After hatching, larval chigger mites emerge and begin an active search for suitable hosts. After attaching to the host and obtaining a prolonged meal, the chigger mite then drops off its host and matures into the nymphal and adult stages of its life cycle. There is no further ongoing infestation of the affected host, unless there are encounters with further larval chiggers in their habitat. Thus, patients usually present with symptoms of bites well after the chigger mites have already dropped off.<sup>17</sup>

Similarly, mites found among other species and vegetative habitats may bite and infest human hosts opportunistically. The prevalence of these infestations is not known, but it is not thought to represent a frequent interaction between humans and other species of mite ectoparasites.

### Clinical Manifestations and Diagnosis

Itching and discomfort may arise in several hours or days after bites from chiggers and other mites.<sup>17,18</sup> (See Figure 4.) Manifestations include intensely pruritic groupings of erythematous welts, maculopapular lesions, blebs or vesicles, and even persistent nodules, often grouped in regions where clothing is worn tightly against the body (e.g., belt lines). (See Figure 5.)

In South and Southeast Asia, East Asia, and Northern Australia, bites

from chigger mites may transmit scrub typhus, which may manifest with a small black eschar at the bite site.<sup>17</sup> After a brief incubation period of 10 days after being bitten, patients may develop fever, chills, headache, myalgias, altered mental status, and occasional rash.

### Treatment

Bites from chiggers and other mites in the United States should be treated symptomatically, since the arthropods typically drop off the host after feeding and do not constitute an ongoing infestation. These may be treated with oral antihistamines and topical corticosteroids.<sup>17</sup>

## Lice

### Description and Epidemiology

There are three forms of human lice: head lice (*Pediculus capitis*), body lice (*Pediculus humanus*), and pubic lice (*Phthirus pubis*).<sup>18</sup>

For the average practitioner, head and body lice are indistinguishable by morphology, and instead must be differentiated by location on the patient — head lice inhabit the hairs of the scalp, while those found on the body or clothing are more reliably body lice.<sup>18</sup> Both species range in size from 2 mm to 4 mm, with a typically pale beige or gray coloration, and appear flattened dorsoventrally with an elongated abdominal section. (See Figures 6 and 7.) The eggs (nits) of head lice may be cemented to the longer hairs of the scalp, typically one per strand, while those of body lice may be found among the fibers of clothing or along seams. The eggs of either species are typically about 1 mm in length.

Pubic lice typically are smaller in size (1 mm to 2 mm) with a squat, broad, and rounded body morphology.<sup>18</sup> (See Figure 8.) The presence of large claws on the mid- and hind-legs, along with a more sluggish movement compared to its body and head brethren, has led to its colloquial designation as the “crab louse.”

All three species are distributed globally, likely as a result of traveling with human migrations out of Africa millions of years ago.<sup>24,25</sup> Head lice are found more frequently among children attending school and day

**Figure 6. Head Louse**



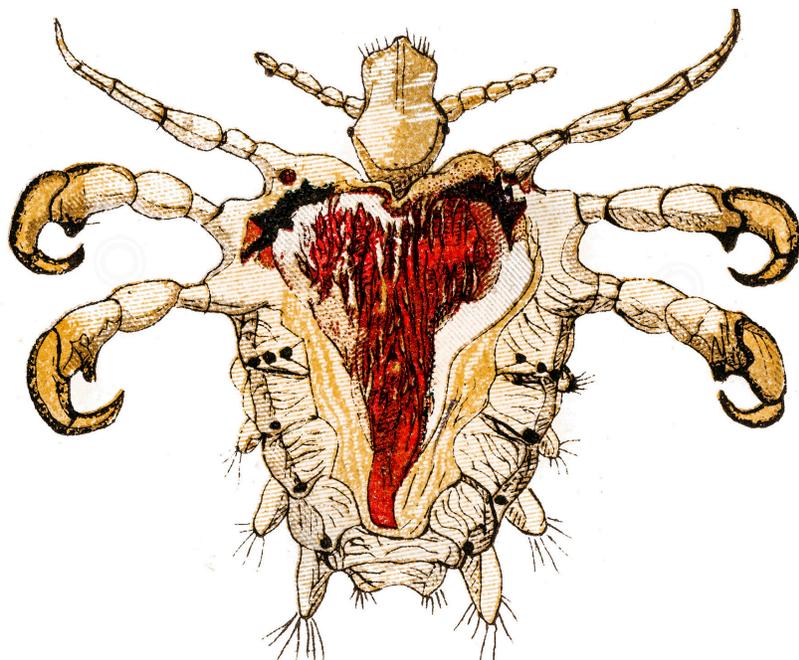
Source: Getty Images

**Figure 7. Body Louse**



Source: CDC/ Dr. Dennis Juranek.

**Figure 8. Crab Louse**



Source: Getty Images

**Figure 9. Head Louse Eggs Cemented to Hair Strand**

This photomicrograph depicts an unhatched egg of a head louse, *Pediculus humanus* var. *capitis* still attached to a human hair shaft. You are able to see the louse embryo developing inside the egg.



Source: CDC/ Dr. Dennis Juranek.

care, as well as among their mothers and siblings. Similar to scabies infestations, head lice transmission may occur more frequently in the winter because of crowding.<sup>10</sup> Although resource-poor communities may have higher burdens of infestations, transmission still occurs among schoolchildren regardless of bathing habits or

socioeconomic status.<sup>25</sup> Body lice, on the other hand, may be found among individuals experiencing crowding and lack of regular hygiene, such as homeless populations, inmates of primitive jails, and refugees.<sup>26-30</sup> Pubic lice are transmitted primarily through sexual contact or through shared bedding or clothing.<sup>31</sup>

Body lice are capable of transmitting epidemic typhus (*Rickettsia prowazekii*), louse-borne relapsing fever (*Borrelia recurrentis*), and trench fever (*Bartonella quintana*).<sup>29,30</sup> Epidemic typhus is relatively rare in the United States. Cases and outbreaks have been noted internationally in mountainous regions of Asia and in some parts of Europe, Africa, and Latin America. As with the groups at risk for body lice, these outbreaks have been associated with refugees and jail populations, among others. Similarly, trench fever has been documented among homeless populations.<sup>26</sup>

#### Life Cycle and Pathophysiology

All lice feed several times per day by traumatizing the outer layers of the skin or scalp with their claws, injecting an anticoagulating saliva, and ingesting the host's blood.<sup>18,19</sup>

Body lice and head lice have similar life cycles, except each chooses to lay its eggs in different locations. Female head lice lay five to 10 eggs per day, typically glued to the base of hairs on the scalp.<sup>19</sup> (See Figures 9 and 10.) Eggs typically hatch in five to 10 days. It has been said that the duration of a head lice infestation can be estimated by the distance of unhatched eggs along the length of a hair, given that the louse laid the egg at the base of the scalp and human hair grows at a rate of about 1 cm per month.<sup>18</sup> Most infestations only number in the range of 10 to 20 adult individuals, although more severe circumstances are possible.

Similarly, female body lice typically lay five to 10 eggs per day over their lifespan, which amounts to two to four weeks.<sup>18</sup> These eggs are laid on the fibers of clothing and seams of underclothes. In total, body lice infestations can number anywhere in the hundreds to thousands of adult individuals in more severe manifestations. These lice typically take multiple blood meals throughout the day and night from the host's skin.

Both species die in two to four days without a human host, although they may last longer if given a fresh blood meal.<sup>18</sup> Body lice eggs may hatch from discarded clothing after two to three weeks. Eggs cannot survive for

more than a month. Body lice typically are transmitted by close contact, especially when people wear multiple layers of clothing that are not washed frequently. Head lice require close and prolonged contact for transmission, such as among children playing or living together or in crowded conditions. Items such as hats, combs, or brushes may harbor individual head lice that have become unattached from the scalp, but these are infrequent contributors to transmission.

Female pubic lice may lay up to three eggs per day, and unlike their body and head brethren, these all may be attached to one hair.<sup>18</sup> Individuals usually only live three to four weeks. Transmission usually occurs through sexual contact, but transmission through shared bedding also is reported.<sup>31</sup> Although pubic lice rarely are found on the head, they may venture to other regions of thick and curly body hair, such as the chest or beard.<sup>18</sup>

### Clinical Manifestations and Diagnosis

The most common manifestation of all louse infestations is pruritus due to the irritation of injected saliva during feeding behavior.<sup>32</sup> Infestations of head lice (*P. capitis*) may manifest with irritation, excoriation, and local inflammation, with secondary bacterial infection and the development of pustules, crusting, and posterior cervical lymphadenopathy.<sup>19</sup>

Body lice infestations (*Pediculosis corporis*, or, with significant infestations of clothing, *Pediculosis vestimenti*) similarly may be irritating with eczematous reactions, pustules, furunculosis, or, in the case of longstanding and severe disease, may produce a pigmented and tough texture to the skin, a condition known as vagabond's disease or parasitic melanoderma.<sup>32-34</sup>

Body lice and pubic lice also may produce gray-blue macules at sites of infestation, known as maculae ceruleae.<sup>33,35,36</sup> (See Figure 11.) Although the exact pathophysiology of these lesions remains unclear, they are thought to represent blood pigment in the skin left from louse feeding behaviors.

**Figure 10. Head Lice**



Source: Kosta Mumcuoglu / CC-BY-SA-3.0

**Figure 11. Maculae Ceruleae**



Reprinted with permission: Nguyen CV, Kingsley-Loso JL. Bites that spur the blues: Maculae ceruleae. *Am J Med* 2019;132:333-334.

**Figure 12. Pubic Lice on Eyelashes**



Source: Kosta Mumcuoglu / CC-BY-SA-3.0

In children, pubic lice also may infest the eyelashes, which may lead to irritation, blepharitis, and purulent discharge.<sup>37</sup> (See Figure 12.) Note that head lice do not infest the eyelashes, and the discovery of lice in the eyelashes is highly suggestive of child sexual abuse unless proven otherwise.<sup>36,37</sup>

### Treatment

The same pediculicides may be used for all types of lice infestations.<sup>38</sup> For head lice, over-the-counter 1% permethrin lotion or pyrethrin combined with piperonyl butoxide generally are used as first-line treatments.<sup>32</sup> Since no therapy is completely ovicidal, treatment should be repeated seven to 10 days later to kill lice hatched from eggs present during the first course. Unfortunately, increasing resistance to these pediculicides has been documented in the United States.<sup>39</sup>

Second-line therapy uses malathion, benzyl alcohol lotion, spinosad suspension, or ivermectin lotion, or, in children weighing more than 15 kg, oral ivermectin.<sup>32</sup> As with permethrin or pyrethrin, treatment should be repeated seven to 10 days after the first course. After successful treatment, nit removal may be accomplished with a fine-toothed comb to

decrease the risk of self-reinfestation, as well as to prevent diagnostic confusion.

The treatment of body lice primarily focuses on improved hygiene and removal of infested clothing. Discarding infested clothing or bedding is preferable. For clothing, laundering with hot water, dry cleaning, machine drying at hot temperatures, or pressing with a hot iron is recommended, since lice cannot survive temperatures higher than 128° F (53° C).<sup>40</sup> Infested bedding also must be decontaminated or discarded. Although regular bathing and laundering are the mainstays of treatment, those with extensive body hair may require treatment with application of a topical pediculicide, as described above.

Likewise, the same pediculicides may be used in the treatment of pubic lice. Manual removal of lice and nits may be accomplished with a fine-toothed comb, or infested regions of pubic hair may be shaved.<sup>36</sup> Topical pediculicides should not be used to treat eyelash infestations, but rather ophthalmic-grade petrolatum ointment should be applied to the eyelashes two to four times daily for 10 days. Practitioners always should screen and treat for other sexually transmitted infections

in those with pubic lice infestations. The possibility of sexual abuse also should be evaluated in children.

### Conclusion

Providers in the pediatric emergency department frequently must diagnose and treat manifestations of ectoparasitic infestations. When dealing with lice and scabies, providers always should remember that some hosts mount a more robust hypersensitivity response than others. Simply because only one member of a family seems to be experiencing possible bites does not exclude an infestation affecting an entire household.

Although scabies is probably one of the most commonly encountered ectoparasitic infestations in emergency department patients, providers should remain vigilant and knowledgeable of other possible infestations. This concludes the first part of this series, focusing on lice and scabies; the second part will discuss similarly relevant bites from bed bugs and ticks.

### References

1. Diaz JH. Introduction to Ectoparasitic Diseases. In: Bennett JE, Dolin R, Blaser MJ, eds. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*. 8th ed. New York: Elsevier Saunders; 2015.
2. Chosidow O. Scabies. *N Engl J Med* 2006;354:1718-1727.
3. Hay RJ, Steer AC, Engelman D, Walton S. Scabies in the developing world—its prevalence, complications, and management. *Clin Microbiol Infect* 2012;18:313-323.
4. Heukelbach J, Mazigo HD, Ugboimoiko US. Impact of scabies in resource-poor communities. *Curr Opin Infect Dis* 2013;26:127-132.
5. Mounsey KE, Murray HC, King M, Oprescu F. Retrospective analysis of institutional scabies outbreaks from 1984 to 2013: Lessons learned and moving forward. *Epidemiol Infect* 2016;144:2462-2471.
6. Makigami K, Ohtaki N, Yasumura S. A 35-month prospective study on onset of scabies in a psychiatric hospital: Discussion on patient transfer and incubation period. *J Dermatol* 2012;39:160-163.
7. Meyer EP, Heranney D, Foeglé J, et al. [Management of a scabies epidemic in the Strasbourg teaching hospital, France]. In French. *Med Mal Infect* 2011;41:92-96.

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8. Larrosa A, Cortés-Blanco M, Martínez S, et al. Nosocomial outbreak of scabies in a hospital in Spain. *Euro Surveill* 2003;8:199-203.
9. Andersen BM, Haugen H, Rasch M, et al. Outbreak of scabies in Norwegian nursing homes and home care patients: Control and prevention. *J Hosp Infect* 2000;45:160-164.
10. Downs AMR, Harvey I, Kennedy CTC. The epidemiology of head lice and scabies in the UK. *Epidemiol Infect* 1999;122: 471-477.
11. Karimkhani C, Colombara DV, Drucker AM, et al. The global burden of scabies: A cross-sectional analysis from the Global Burden of Disease Study 2015. *Lancet Infect Dis* 2017;17:1247-1254.
12. Roberts LJ, Huffam SE, Walton SF, Currie BJ. Crusted scabies: Clinical and immunological findings in seventy-eight patients and a review of the literature. *J Infect* 2005;50: 375-381.
13. Mounsey KE, Murray HC, King M, Oprescu F. Retrospective analysis of institutional scabies outbreaks from 1984 to 2013: Lessons learned and moving forward. *Epidemiol Infect* 2016;144:2462-2471.
14. Baysal V, Yildirim M, Türkman C, et al. Crusted scabies in a healthy infant. *J Eur Acad Dermatol Venereol* 2004;18:188-190.
15. Gladstone HB, Darmstadt GL. Crusted scabies in an immunocompetent child: Treatment with ivermectin. *Pediatr Dermatol* 2000;17:144-148.
16. Bongiorno MR, Ferro G, Aricò M. Norwegian (crusted) scabies of glans penis in an immunocompetent patient. *Br J Dermatol* 2009;161:195-197.
17. Diaz JH. Mites, Including Chiggers. In: Bennett JE, Dolin R, Blaser MJ, eds. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*. 8th ed. New York: Elsevier Saunders; 2015.
18. Service M. *Medical Entomology for Students*. 3rd ed. Cambridge, UK: Cambridge University Press; 2004.
19. Habif TP. Infestations and bites. In: Habif TP. *Clinical Dermatology: A Color Guide to Diagnosis and Therapy*. 6th ed. Philadelphia: Elsevier; 2016.
20. Hill TA, Cohen B. Scabies in babies. *Pediatr Dermatol* 2017;34:690-694.
21. Scabies. In: Kimberlin DW, Brady MT, Jackson MA, Long SS, eds. *Red Book 2018 Report of the Committee on Infectious Diseases*. 31st ed. Elk Grove Village, IL: American Academy of Pediatrics; 2015.
22. Fradin MS, Carroll SP. Protection from Blood-Feeding Arthropods. In: Auerbach PS, Cushing TA, Harris NS, eds. *Auerbach's Wilderness Medicine*. 7th ed. Philadelphia: Elsevier; 2017.
23. Xu G, Walker DH, Jupiter D, et al. A review of the global epidemiology of scrub typhus. *PLoS Negl Trop Dis* 2017;11:e0006062.
24. Boutellis A, Abi-Rached L, Raoult D. The origin and distribution of human lice in the world. *Infect Genet Evol* 2014;23:209-217.
25. Falagas ME, Matthaïou DK, Rafailidis PI, et al. Worldwide prevalence of head lice. *Emerg Infect Dis* 2008;14:1493-1494.
26. Bonilla DL, Cole-Porse C, Kjemtrup A, et al. Risk factors for human lice and bartonellosis among the homeless, San Francisco, California, USA. *Emerg Infect Dis* 2014;20:1645-1651.
27. Arnaud A, Chosidow O, Détrez MA, et al. Prevalences of scabies and pediculosis corporis among homeless people in the Paris region: Results from two randomized cross-sectional surveys (HYTPEAC study). *Br J Dermatol* 2016;174:104-112.
28. Gravinatti ML, Faccini-Martínez ÁA, Ruys SR, et al. Preliminary report of body lice infesting homeless people in Brazil. *Rev Inst Med Trop Sao Paulo* 2018;60:e9.
29. Raoult D, Roux V. The body louse as a vector of reemerging human diseases. *Clin Infect Dis* 1999;29:888-911.
30. Roux V, Raoult D. Body lice as tools for diagnosis and surveillance of reemerging diseases. *J Clin Microbiol* 1999;37:596-599.
31. Salavastru CM, Chosidow O, Janier M, Tiplica GS. European guideline for the management of *Pediculosis pubis*. *J Eur Acad Dermatol Venereol* 2017;31:1425-1428.
32. Pediculosis Capitis. In: Kimberlin DW, Brady MT, Jackson MA, Long SS, eds. *Red Book 2018 Report of the Committee on Infectious Diseases*. 31st ed. Elk Grove Village, IL: American Academy of Pediatrics; 2015.
33. James WD, Berger TG, Elston DM. Parasitic Infestations, Stings, and Bites. In: James WD, Berger TG, Elston DM, eds. *Andrews' Diseases of the Skin*. 12th ed. Philadelphia: Elsevier; 2016.
34. Currie MJ, Bowden FJ, McCarthy JS. Louse Infestation. In: Farrar J, Hotez PJ, Junghans T, et al, eds. *Manson's Tropical Diseases*. 23rd ed. Philadelphia: Elsevier Limited; 2014.
35. Diaz JH. Lice (Pediculosis). In: Bennett JE, Dolin R, Blaser MJ, eds. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*. 8th ed. New York: Elsevier Saunders; 2015.
36. Pediculosis Pubis. In: Kimberlin DW, Brady MT, Jackson MA, Long SS, eds. *Red Book 2018 Report of the Committee on Infectious Diseases*. 31st ed. Elk Grove Village, IL: American Academy of Pediatrics; 2015.
37. Ryan MF. *Phthiriasis palpebrarum* infection: A concern for child abuse. *J Emerg Med* 2014;46:e159-162.
38. Drugs for Parasitic Infections. In: Kimberlin DW, Brady MT, Jackson MA, Long SS, eds. *Red Book 2018 Report of the Committee on Infectious Diseases*. 31st ed. Elk Grove Village, IL: American Academy of Pediatrics; 2015.
39. Lebowitz M, Clark L, Levitt J. Therapy for head lice based on life cycle, resistance, and safety considerations. *Pediatrics* 2007;119:965-974.
40. Pediculosis Corporis. In: Kimberlin DW, Brady MT, Jackson MA, Long SS, eds. *Red Book 2018 Report of the Committee on Infectious Diseases*. 31st ed. Elk Grove Village, IL: American Academy of Pediatrics; 2015.

## CME/CE Questions

1. A previously healthy 4-year-old boy presents to your emergency department with a complaint of intensely pruritic, erythematous papules along his beltline, between his fingers, and on his wrists. In reviewing the chart, you find he was diagnosed and treated by one of your partners two months earlier for scabies, with a recommendation for over-the-counter topical 5% permethrin, with two applications separated one week apart. The mother responds that the boy seemed to improve after this treatment, but now he seems to have worsened in the past week. What is the next best step?
  - a. His infestation has demonstrated resistance, and therefore oral ivermectin should be used next as a second-line therapy.
  - b. Assume his mother did not adequately apply the topical solution your partner prescribed, and ask to perform one treatment in your ED with clearer instructions and guidance for the mother.
  - c. Ask if the other household contacts were treated, and if not, recommend a course of therapy for all cohabitants.
  - d. This is not likely a scabies infestation, but instead represents an undetected bed bug infestation at home; recommend the family contact a pest control company.
2. A 17-year-old young man presents to your department with a complaint of pubic lice. Examination reveals several adult lice in the hairs of the pubic region, with nits attached to multiple hairs, and some excoriations. What is the next best step?
  - a. Obtain a detailed sexual history and recommend two treatments seven to 10 days apart of topical over-the-counter permethrin solution.
  - b. Obtain a detailed sexual history, screen for chlamydia, gonorrhea, syphilis, and HIV, and recommend two treatments seven to 10 days apart of topical over-the-counter permethrin solution.
  - c. Obtain a detailed sexual history, screen for chlamydia, gonorrhea, syphilis, and HIV, and prescribe a one-time dose of oral ivermectin.
  - d. Obtain a detailed sexual history and recommend two treatments seven to 10 days apart of topical over-the-counter permethrin solution, or shaving of affected body regions, depending on patient preference.
3. A 10-year-old previously healthy girl presents to your department with a complaint of head lice infestation. Her mother reports that there is an outbreak at her school and multiple children have been kept at home. On examination, you discover several adult lice in her hair, along with nits attached to multiple hair shafts, pruritic and irritated lesions along her scalp, and posterior cervical lymphadenopathy. Her mother notes that the infestation also has spread to her eyelashes, and directs your attention to her eyelids, which are irritated with scant discharge, and several arthropods can be seen clinging to her eyelash hairs. What is the next best step?
  - a. Recommend over-the-counter 1% permethrin lotion to be used in the scalp and carefully along the eyelashes, and again one week later, with primary care follow-up.
  - b. Recommend over-the-counter 1% permethrin lotion to be used on the scalp and the eyelashes two to four times daily for 10 days, with primary care follow-up.
  - c. Recommend oral ivermectin to be used for both to avoid getting topical preparations in her eyes, with primary care follow-up.
  - d. Document thoroughly, obtain arthropod specimens from both locations, examine their morphology, and prepare to report her case to child protective services while also initiating treatment.

## PEDIATRIC EMERGENCY MEDICINE REPORTS

### CME/CE Objectives

Upon completion of this educational activity, participants should be able to:

- recognize specific conditions in pediatric patients presenting to the emergency department;
- describe the epidemiology, etiology, pathophysiology, historical and examination findings associated with conditions in pediatric patients presenting to the emergency department;
- formulate a differential diagnosis and perform necessary diagnostic tests;
- apply up-to-date therapeutic techniques to address conditions discussed in the publication;
- discuss any discharge or follow-up instructions with patients.

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