Overview: The State of Head Lice Management and Control

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Abstract

Head lice infestations affect millions of people in the United States. Children become infested more often than adults and account for the largest percentage of infestations. Head lice have not been shown to transfer disease, and they are not associated with serious morbidity. The most common effect of lice infestation is pruritus of the scalp with occasional cutaneous infection caused by scratching. Nevertheless, many schools have "no-nit" policies, which require the dismissal of children from school if nits or lice are found. These policies are ineffective in preventing infestations and result in many missed days of school.

Lice infestations are most effectively managed with pediculicides. Pyrethroids are the mainstay of over-the-counter products. Prescription pediculicides include OVIDE® (malathion) Lotion, 0.5% and lindane (formerly marketed as Kwell). Resistance to pyrethroids due to misuse and overuse has been documented. Lindane resistance also has been reported, and serious safety issues about lindane have been raised by the Food and Drug Administration. Lindane labeling now includes warnings and several restrictions in its use. Malathion is not associated with major systemic safety issues or the development of resistance within the United States.

A contributor to pediculicide resistance is misdiagnosis of lice infestations. Survey data reveal frequent misdiagnosis of infestations in children who do not have live lice. Physicians generally are more likely to misdiagnose infestations than nonhealthcare providers. Misdiagnosis contributes to resistance by causing overuse, and consequently overexposure, of pediculicides. These agents should be used only if live lice or viable nits are discovered.

Head lice infestations generally do not contribute to health risks for individuals or the public. The most serious consequence is the social cost of missed school days and the associated cost of lost productivity and wages of parents who must care for children sent home from school. Better diagnosis, more appropriate use of pediculicides, and elimination of no-nit policies will improve the overall management of head lice infestations.

(Am J Manag Care. 2004;10:S260-S263)

Incidence and Prevalence of Head Lice

Head lice infestations (*Pediculus humanus capitis*) occur worldwide. Although more common in developing countries, head lice infestations are endemic in the United States, particularly among school-aged children.[1] Approximately 6 million to 12 million infestations occur per year in the United States among children 3 to 12 years of age.[2] These figures are estimates, however, because patients may self-treat, so many cases of infestation are never disclosed to health officials.

The beginning of the school year is often associated with lice infestations among children. In fact, infestations take place throughout the year, and peak activity occurs during the summer.[3] In warm temperatures or environments, lice lay more eggs than in cooler temperatures and are generally more active. Children who interact with one another during warm weather may transfer lice to siblings and playmates. Infestations are more commonly spread within families than within schools because of close personal contact and shared brushes and combs.[3,4] "Epidemics" may seem to occur in September because school nurses or other school staff often screen for lice as a means of controlling the spread of infestations, and children who are infested may transfer lice to school playmates during close contact. In reality, infestations do not begin or end with the school year. The perceived increase in lice activity in the fall may have more to do with monitoring practices than with actual numbers of lice.[5]

A common misconception is that infestations occur more frequently among lower income populations, but head lice are found among all socioeconomic groups.[2] Infestations also occur among most ethnic groups in the United States, although African Americans are less likely to be affected. This

lower prevalence rate is thought to be the result of differences in the structure of the hair shaft, which may be oval shaped and therefore more difficult for a louse to grasp.[2,3] There are, however, lice that have adapted to the hair type commonly found among African Americans, so the incidence in this population is increasing.[3] In the United States, girls are somewhat more likely than boys to become infested, perhaps because of the sharing of brushes and combs.[1,3] There is disagreement in the reported literature about whether long hair increases the likelihood of becoming infested,[6] but increased risk of infestation among children with long hair may be again associated with gender differences and the practice of sharing grooming items.[1,3] Short hair does not prevent infestation with head lice.[6] Complete shaving of the head generally does eliminate lice and prevents reinfestation but is rarely an appropriate measure to take in response to infestation.

Pathophysiology and Life Cycle of the Head Louse

Pediculus humanus capitis is an ectoparasite that lives only on human hosts. No animal hosts are associated with head lice. Lice survive by feeding on blood drawn from the host's scalp. Lice may feed and mate as often as every 4 hours and may do both concurrently.[3]

A female louse lays an average of 5 to 10 eggs per day. Lice prefer warm environments, so in cool or temperate climates lice lay eggs close to the scalp and may lay fewer eggs. In warmer climates, however, lice may lay eggs farther away from the scalp and may lay more eggs. Once hatched, lice can survive for up to 30 days. Despite the large number of eggs that can be laid and the lifespan of the louse, the average infested host has only approximately 20 active head lice at one time. Hosts who are not able to groom themselves may have more.[3]

Females, at an average length of 2.4 to 3.3 mm, are slightly larger than males, which range from 2.1 to 2.6 mm. Eggs, or nits, are very small and are silver-gray in color. Shells left behind once the nit emerges tend to dry up but may be mistaken for live lice or viable nits. Adult lice can adapt to the color of their surroundings. The small size of lice and their ability to camouflage themselves can make them difficult to see.

Lice infestations are spread primarily by direct head-to-head contact. Less commonly, fomites such as hats, scarves, and brushes may transfer lice from one host to another.[1-3] However, lice cannot survive for long when away from the host, so transfer by fomite must occur relatively quickly. A louse that has fallen from the host onto another surface, such as the floor, probably will not survive to infest a new host. It is a common but incorrect belief that lice jump from head to head. Lice cannot jump, fly, or crawl long distances. Close, personal contact generally is required for an infestation to spread.[2,3]

Effects on the Host

When lice feed, they inject saliva into the host to promote vasodilation. The saliva may produce an immune response in the host, leading to pruritus.[1,3] A louse's fecal material may also contribute to scalp irritation. Scratching an itchy scalp occasionally causes cutaneous scalp infection, but infestation generally is not associated with serious morbidity.[1,2] In the United States, the primary consequence of head lice infestation is social, affecting relationships or attendance at school or work. It is accurate to say that the greatest "morbidity" associated with lice infestation is missed school days because of "no-nit" policies. These policies, which are intended to control in-school infestations, prohibit attendance by children who have evidence of head lice. Children who attend schools with no-nit policies may miss several days of school per year. In addition to school absences, children may be scorned by classmates because of the stigma attached to lice infestation in the United States. Although socially embarrassing, required absence from school adds to the burden of children who are infested by isolating them and causing them to miss valuable classroom experience. (This topic will be discussed in more detail in the article in this supplement titled, "Treating and Managing Head Lice: The School Nurse Perspective.") Medical and nursing professionals should resist attempts to exclude children from school and work with policy makers to

control infestations with less negative impact on individually affected students.

Treatment Issues

Pyrethroids are the mainstay of over-the-counter pediculicides and include products containing permethrin 1% (eg, Nix®) and synergized pyrethrins (eg, A-200®, RID®, Pronto, and R&C® shampoo). Pyrethrins are "synergized" by the addition of piperonyl butoxide, which enhances the pediculicide effects of pyrethrins. Prescription pediculicides include OVIDE® (malathion) Lotion, 0.5% and lindane (formerly marketed as Kwell).

Resistance is a primary concern in selecting an appropriate treatment. Documented resistance to pyrethroids and lindane is well established.[7] Resistance to one type of pyrethroid product probably indicates resistance to any product in the class. Despite increasing resistance, these products are still widely used because they are available over-the-counter and are therefore easy to obtain for at-home treatment. Among prescription products, lindane resistance has also been noted.[7] In addition, the safety of lindane has been called into question by the Food and Drug Administration, which now recommends its use only in certain patients for whom other pediculicides have failed.[8] Given its reduced efficacy because of resistant lice, as well as safety concerns, lindane is not recommended as first-line treatment. Malathion, another topical prescription pediculicide, is not associated with systemic safety issues or the development of resistance within the United States.[7]

Generally accepted criteria for documenting resistance are still under discussion. Some practitioners state that if a product has been correctly used but lice are still present 2 to 3 days later, resistance is likely to have occurred. Topical pediculicides should be reapplied if live lice are seen 7 to 10 days after the first applications.[2] If lice are present after 2 correctly applied treatments, resistance to the pediculicide is certain.

Another significant issue associated with treatment is misdiagnosis. According to research by Pollack et al, misdiagnosis of lice infestation occurs frequently, causing inappropriate quarantine and treatment of children who are not infested and undertreatment of children with active infestations.[9] In a study of diagnostic accuracy among children suspected of head lice infestation, misdiagnosis occurred because screeners often could not distinguish live, viable lice from other materials, such as dandruff, epidermal matter, and other debris. Presence of these materials frequently resulted in misdiagnosis of active infestation; conversely, screeners often overlooked live lice among children who did have active infestations. The result was that children who were not infested were excluded from school more often than children who had live infestations. Interestingly, physician diagnosis of lice infestation was least accurate, although nonhealthcare providers also frequently misdiagnosed the condition. School nurses were most accurate but failed to distinguish live from extinct infestations. Researchers concluded that misdiagnosis is common, that treatment should be recommended only with the discovery of live lice or viable nits, and that no-nit policies should be reevaluated because so many children are inappropriately excluded from school.[9]

Resistance and misdiagnosis have been shown to result in unnecessary and inappropriate treatment with pediculicides. Aside from the social effects of inappropriate treatment, there are cost consequences. Accurate estimates of the total costs of treatment in the United States are difficult to obtain, but informal estimates based on the standard cost of over-the-counter pediculicides used twice would be approximately $120 million for the lower range of 6 million infestations per year.[10] Higher estimates of infestations and the need for repetitive application when treatments fail because of resistance substantially increase the total costs of eradicating head lice. Added to the direct costs of pediculicides are the indirect costs of lost productivity because of missed school and work days. More discussion of direct and indirect costs of treatments is included in the article in this supplement titled, "Head Lice Treatment Costs and the Impact on Managed Care."

Conclusions

Lice infestation is viewed as a socially repugnant condition, but it is not associated with significant morbidity except for pruri-

tus and occasional pyoderma. Among children, who are most likely to become infested, the primary negative effect of lice infestation is absence from school. Well-meaning but misguided school policies that exclude children with lice infestation should be revised or eliminated. Research has demonstrated that misdiagnosis of lice infestation is common, and a significant number of children who are sent home do not have active infestations.[9] This, coupled with resistance to commonly used pyrethroid pediculicides, results in inappropriate and unnecessary head lice treatment commonly occurring among school-aged children.

The effects of misdiagnosis and resistance are costly in terms of direct and indirect costs to society. Direct costs include costs of treatment, which may be repeated several times if lice are resistant. Indirect costs are even more substantial, including missed days from school and parental work days missed to care for a child who has been sent home from school. Recommendations for improving treatment include increasing the accuracy of diagnosis, treating only those children who have confirmed, active infestations, resisting no-nit policies, and using pediculicides properly to decrease overexposure to children and the possibility of promoting treatment-resistant lice. Ultimately, the development of new pediculicides will be needed as resistance increases. These topics will be described in more detail in this supplement.

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