

# AMERICAN ACADEMY OF PEDIATRICS

## CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

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### Head Lice

**ABSTRACT.** Head lice infestation is associated with little morbidity but causes a high level of anxiety among parents of school-aged children. This statement attempts to clarify issues of diagnosis and treatment of head lice and makes recommendations for dealing with head lice in the school setting.

ABBREVIATION. FDA, Food and Drug Administration.

#### INTRODUCTION

Head lice (*Pediculus capitis*) infestation is common in the United States among children 3 to 12 years of age; approximately 6 to 12 million have infestations each year. Head lice are not a health hazard or a sign of uncleanliness and are not responsible for the spread of any disease. The most common symptom is itching. Individuals with head lice infestation may scratch the scalp to alleviate itching, and there rarely may be secondary bacterial skin infection. Head lice are the cause of much embarrassment and misunderstanding, many unnecessary days lost from school and work, and millions of dollars spent on remedies.

#### ETIOLOGIC AGENT

The adult louse is 2 to 3 mm long (the size of a sesame seed) and usually pale gray, although color may vary. The female lives up to 3 to 4 weeks and lays approximately 10 eggs, or nits, a day. These tiny eggs are firmly attached to the hair shaft close to the scalp with a glue-like substance produced by the louse. Viable nits camouflaged with pigment to match the hair color of the infested person are most easily seen at the posterior hairline. Empty nit casings are easier to see, appearing white against darker hair. The eggs are incubated by body heat and hatch in 10 to 14 days. Once the eggs hatch, nymphs leave the shell casing, grow for about 9 to 12 days, and mate, and then females lay eggs. If not treated, this cycle may repeat itself every 3 weeks.<sup>1</sup> While the louse is living on the head, it feeds by injecting small amounts of saliva and taking tiny amounts of blood

from the scalp every few hours. This saliva may create an itchy irritation. With a first case of head lice, itching may not develop for 4 to 6 weeks, because it takes time to develop a sensitivity to louse saliva. Head lice usually survive for less than 1 day away from the scalp at normal room temperature, and their eggs cannot hatch at an ambient temperature lower than that near the scalp.<sup>2</sup>

#### CLINICAL DISEASE

Head lice, unlike body lice, do not transmit any disease agents.<sup>3</sup> Itching may develop in a sensitized individual. Rarely, an individual may develop impetigo and local adenopathy from scratching.

#### EPIDEMIOLOGY

Head lice are most common in children 3 to 12 years of age. All socioeconomic groups are affected. Infestations in the United States are less common in blacks than in individuals of other races, most likely because blacks have oval-shaped hair shafts that are harder for lice to grasp. Head lice in Africa have adapted claws for grasping this type of hair.<sup>2</sup> Head lice infestation is not significantly influenced by hair length or by frequent brushing or shampooing. However, in the United States, where daily brushing is routine, infested individuals rarely have more than a dozen live lice, whereas individuals in cultures with different grooming practices often have a hundred or more live lice. Lice cannot hop or fly; they crawl. Transmission in most cases occurs by direct contact with the head of another infested individual.<sup>4</sup> Indirect spread through contact with personal belongings of an infested individual (combs, brushes, hats) is much less likely but cannot be excluded. Lice found on combs are likely to be injured or dead,<sup>5</sup> and a healthy louse is not likely to leave a healthy head.<sup>6</sup>

#### DIAGNOSIS

The gold standard for diagnosing head lice is finding a live louse on the head. This can be difficult, because the louse can crawl 6 to 30 cm per minute. The tiny eggs, or nits, may be easier to spot, especially at the nape of the neck or behind the ears, within 1 cm of the scalp. It is important not to confuse nits with dandruff, hair casts, or other hair debris; nits are more difficult to remove because they

The recommendations in this report do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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are “glued” on. It is also important not to confuse live nits with dead or empty egg cases. Among presumed “lice” and “nits” submitted by physicians, nurses, teachers, and parents to a laboratory for identification, many were found to be artifacts such as dandruff, hairspray droplets, scabs, dirt, or other insects (eg, aphids blown by the wind and caught in the hair).<sup>7</sup> In general, nits found more than 1 cm from the scalp are unlikely to be viable, but some researchers in warmer climates have found viable nits farther from the scalp.<sup>2</sup> A viable nit will develop an “eye spot” evident on microscopic examination several days after being laid.

### PREVENTION

It is probably impossible to totally prevent head lice infestations. Young children come into close head-to-head contact with each other frequently. It is prudent for children to be taught not to share personal items such as combs, brushes, and hats. In environments where children are together, adults should be aware of the signs and symptoms of head lice infestation, and affected children should be treated promptly to minimize spread to others.

### TREATMENT

#### Pediculicides

##### *Pyrethrins Plus Piperonyl Butoxide*

Manufactured from natural extracts from the chrysanthemum, pyrethrins plus piperonyl butoxide (RID [Bayer, Morristown, NJ], A-200 [Hogill Pharmaceutical Corp, Purchase, NY], R & C [GlaxoSmithKline, Middlesex, United Kingdom] Pronto [Del Laboratories, Uniondale, NY], Clear Lice System [Care Technologies, Darien, CT]), are neurotoxic to lice but have extremely low mammalian toxicity. The labels warn against possible allergic reaction in patients who are sensitive to ragweed, but modern extraction techniques minimize the chance of product contamination, and reports of true allergic reactions are rare.<sup>8</sup> However, pyrethrins should be avoided in persons allergic to chrysanthemums. These products are mostly shampoos that are applied to dry hair and left on for 10 minutes before rinsing out. These and all other topical pediculicides should be rinsed from the hair over a sink rather than in the shower or bath to limit exposure and with cool rather than hot water to minimize absorption attributable to vasodilation.<sup>9</sup> None of these natural pyrethrins are totally ovicidal (newly laid eggs do not have a nervous system for several days); 20% to 30% of the eggs remain viable after treatment.<sup>10</sup> This necessitates a second treatment 7 to 10 days later to kill newly emerged nymphs hatched from eggs that survived the first treatment. Resistance of adult lice to these products has been reported.<sup>11</sup>

##### *Permethrin (1%)*

Manufactured as a synthetic pyrethroid, 1% permethrin (Nix [Pfizer Consumer Health Care Group, New York, NY]) is currently the recommended treatment of choice for head lice.<sup>12–14</sup> It has even lower mammalian toxicity than do pyrethrins and does not

cause allergic reactions in individuals with plant allergies. The product is a cream rinse applied to hair that is first shampooed with a nonconditioning shampoo and then towel dried. It is left on for 10 minutes and then rinsed off, and it leaves a residue on the hair that is designed to kill nymphs emerging from the 20% to 30% of eggs not killed with the first application.<sup>10</sup> However, it is suggested that the application be repeated if live lice are seen 7 to 10 days later. Some experts recommend routine retreatment.<sup>15</sup> Resistance to 1% permethrin has recently been reported,<sup>16–18</sup> but the prevalence of this resistance is not known.

##### *Lindane (1%)*

Lindane (Kwell [Reed & Carnick, Jersey City, NJ]) is an organochloride that has central nervous system toxicity in humans if used incorrectly; several cases of severe seizures in children using lindane have been reported.<sup>1,19–22</sup> It is available only by prescription as a shampoo that should be left on for no more than 10 minutes with repeated application in 7 to 10 days. It has low ovicidal activity (30% to 50% of eggs are not killed<sup>10</sup>), and resistance has been reported worldwide for many years.<sup>23,24</sup> For these reasons, it should be used very cautiously.<sup>15</sup>

##### *Malathion (0.5%)*

The organophosphate (cholinesterase inhibitor) 0.5% malathion (Ovide [Medicis, Phoenix, AZ]) has recently been reintroduced to the US market. It is available only by prescription as a lotion that is applied to the hair, left to air dry, then washed off after 8 to 12 hours. Malathion has high ovicidal activity,<sup>10,25</sup> but the product should be reapplied if live lice are seen in 7 to 10 days. The major concerns are the high alcohol content of the product, making it highly flammable, and the risk of severe respiratory depression if accidentally ingested. For these reasons, it should be used with extreme caution in the treatment of only those cases in which resistance to other products is strongly suspected.<sup>15</sup>

#### Topical Reactions

Itching or mild burning of the scalp caused by inflammation of the skin in response to topical therapeutic agents can persist for many days after lice are killed and is not a reason for retreatment. Topical corticosteroids and oral antihistamines may be beneficial for relieving these signs and symptoms.

#### Other Topical Agents

##### *Permethrin (5%)*

Five percent permethrin (Elimite [Allergan, Irvine, CA]) is available by prescription only as a cream usually applied overnight for scabies. It has anecdotally been recommended for the treatment of head lice that appear to be recalcitrant to other treatments; it should be applied to the scalp and left on for several hours or overnight,<sup>13</sup> then rinsed off. No case-control studies have reported efficacy to date. One study suggested that lice resistant to 1% permethrin will not succumb to higher concentrations.<sup>18</sup> It is not

currently approved by the Food and Drug Administration (FDA) for use as a pediculicide.

#### *Crotamiton (10%)*

This product is available by prescription only as a lotion (Eurax [Westwood-Squibb Pharmaceuticals, Buffalo, NY]) usually used to treat scabies. A single study showed it to be effective against head lice when applied to the scalp and left on for 24 hours before rinsing out.<sup>26</sup> Safety and absorption in children, adults, and pregnant women have not been evaluated. It is not currently approved by the FDA for use as a pediculicide.

#### **Oral Agents**

##### *Sulfamethoxazole/Trimethoprim*

This antibiotic sometimes called cotrimoxazole (Septra [GlaxoSmithKline, Middlesex, United Kingdom], Bactrim [Roche Laboratories, Nutley, NJ]), used in otitis media doses, has been cited as effective against head lice.<sup>27</sup> This antibiotic is postulated to kill the symbiotic bacteria in the gut of the louse or perhaps to have a direct toxic effect on the louse. A recent study indicated increased effectiveness of this antibiotic in combination with permethrin 1% when compared with permethrin 1% or sulfamethoxazole/trimethoprim alone; however, the treatment groups were small.<sup>28</sup> Rare severe allergic reactions (Stevens-Johnson syndrome) to this medication make it a potentially undesirable therapy if alternatives exist.<sup>1</sup> It is not currently approved by the FDA for use as a pediculicide.

##### *Ivermectin*

This product (Stromectal [Merck & Co., West Point, PA]) is an anthelmintic agent structurally similar to the macrolide antibiotics but without antibacterial activity. An oral dose of 200 micrograms/kg, repeated in 10 days, has been shown to be effective against head lice.<sup>29</sup> If ivermectin gets past the blood-brain barrier, it blocks essential neural transmission; young children may be at higher risk for this adverse drug reaction. Therefore, ivermectin should not be used for children who weigh less than 15 kg.<sup>30,31</sup> It is not currently approved by the FDA as a pediculicide.

#### **“Natural” Products**

Several products are marketed by health food stores for treatment of head lice and are in wide use. As natural products, they are not required to meet FDA efficacy and safety standards. HairClean 1–2–3 (Quantum Health, Eugene, OR; anise, ylang ylang, coconut oils, and isopropyl alcohol) was found to be at least as effective as the permethrin product Nix by 1 investigator.<sup>2</sup>

#### **Occlusive Agents**

A “petrolatum shampoo” consisting of 30 to 40 g of standard petroleum jelly massaged on the entire surface of the hair and scalp and left on overnight with a shower cap has been suggested. Diligent shampooing is usually necessary for at least the next 7 to 10 days to remove the residue. It is postulated

that the viscous substance obstructs the respiratory spiracles of the adult louse, blocking efficient air exchange, as well as the holes in the operculum of the eggs.<sup>32</sup> Another interpretation is that the intense, daily attention to hair grooming results in removal of all the lice and nits. Hair pomades are easier to remove but may not kill eggs, and treatment should be repeated weekly for 4 weeks.<sup>33</sup> Other occlusive substances have been suggested (mayonnaise, tub margarine, herbal oils, olive oil), but to date only anecdotal information is available concerning efficacy.

#### **Other Agents**

Flammable or toxic substances, such as gasoline or kerosene, should never be used. Products intended for animal use should not be used to treat head lice in humans.

#### **Manual Removal**

Removal of nits after treatment with a pediculicide is not necessary to prevent spread, because only live lice cause an infestation. Individuals may want to remove nits for aesthetic reasons or to decrease diagnostic confusion. Because none of the pediculicides are 100% ovicidal, manual removal of nits (especially the ones within 1 cm of the scalp) after treatment with any product is recommended by some. Nit removal can be difficult and tedious.<sup>34</sup> Fine-toothed “nit combs” are available to make the process easier.<sup>35,36</sup> Studies have shown that lice removed by combing and brushing are damaged and rarely survive.<sup>5</sup> In the United Kingdom, community campaigns have been launched using “bug buster” combs and ordinary shampoo.<sup>37</sup> Everyone is instructed to shampoo hair twice a week for 2 weeks and vigorously comb out wet hair each time. The wet hair seems to slow down the lice. Combing dry hair does not seem to have the same effect; a study conducted in Australia in which children combed their hair daily at school with an ordinary comb determined that this was not effective.<sup>38</sup> Some postulated that vigorous dry combing or brushing in close quarters may even spread lice by making them airborne via static electricity. Battery-powered “electronic” louse combs that resemble small “bug zappers”<sup>39</sup> or those with oscillating teeth would seem to offer little advantage, if any, over a well-designed traditional louse comb. The teeth of these devices may not effectively reach to the scalp and do not kill or remove nits.

Some products are available that claim to loosen the “glue” that attaches nits to the hair shaft, thus making the process of “nit picking” easier. Vinegar or vinegar-based products (Clear Lice Egg Remover Gel [Care Technologies, Darien, CT]) are intended to be applied to the hair for 3 minutes before combing out the nits. No clinical benefit has been demonstrated.<sup>1,33</sup> Eight percent formic acid (Step 2 [Genderm, Lincolnshire, IL]) is applied to wet hair for 10 minutes before combing out the nits and has been shown to have some benefit in one study.<sup>40</sup> Neither of these products has been tested with or are recommended for use with permethrin because they may interfere



with that product's residual activity. A variety of other products, from acetone and bleach to vodka and WD-40 (WD-40 Company, San Diego, CA), have proved to be ineffective in loosening nits from the hair shaft<sup>33</sup> and present an unacceptable risk to the patient.

### Pediculicide Resistance

No currently available pediculicides are 100% ovicidal, and resistance has been reported with lindane, pyrethrins, and permethrin.<sup>20</sup> This is not unanticipated, because insects have been known to develop resistance to products over time. The actual prevalence of resistance is not known. It is very important that health care professionals continue to recommend safe and clinically tested products. When faced with a persistent case of head lice, health care professionals must consider several possible explanations, including:

- Misdiagnosis (no active infestation or misidentification);
- Noncompliance (not following treatment protocol);
- Reinfestation (lice acquired after treatment);
- Lack of ovicidal or residual killing properties of the product; and/or
- Resistance of lice to the pediculicide.

Even when resistance is suspected, it may be prudent to continue to use a permethrin or pyrethrin product rather than resort to less safe and/or more toxic products. However, select cases may warrant cautious treatment with malathion.<sup>17</sup>

### ENVIRONMENTAL INTERVENTIONS

If an index case is identified, all household members should be checked for head lice, and only those with live lice or nits within 1 cm of the scalp should be treated. It is prudent to treat family members who share a bed with the person with infestation, even if no live lice are found. Fomite transmission is less likely than transmission by head-to-head contact<sup>1</sup>; however, it is prudent to clean hair care items and bedding of the individual with infestation. Only other items, clothing, furniture, or carpeting that have been in contact with the head of the person with infestation in the 24 to 48 hours before treatment should be considered for cleaning, given the fact that louse survival off the scalp beyond 48 hours is extremely unlikely. Washing, soaking, or drying items at temperatures greater than 130°F will kill stray lice or nits. Furniture, carpeting, car seats, and other fabrics or fabric-covered items can be vacuumed. Pediculicide spray should not be used, because exposure cannot be controlled. Nits are unlikely to incubate and hatch at room temperatures; if they did, the nymphs would need to find a source of blood for feeding within hours of hatching. Although it is rarely necessary, items that cannot be washed can be bagged in plastic for 2 weeks, by which time any nits that may have survived would have hatched, and nymphs would die without a source for feeding. Herculean cleaning measures are not beneficial.

### Screening

Screening for nits alone is not an accurate way of predicting which children will become infested, and screening for live lice has not been proven to have a significant effect on the incidence of head lice in a school community over time.<sup>2,15</sup> In addition, such screening has not been shown to be cost-effective. In a prospective study of 1729 school children screened for head lice, only 31% of the 91 children with nits had concomitant lice. Only 18% of those with nits alone converted to an active infestation over 14 days of observation.<sup>41</sup> Although those children having greater than or equal to 5 nits within 1 cm of the scalp were significantly more likely to develop an infestation than those with fewer nits (32% vs 7%), still only 1/3 of these higher-risk children converted. Furthermore, school exclusion of children with nits alone would have resulted in many children missing school unnecessarily in this study population. Several descriptive studies suggest that education of parents in diagnosing and managing head lice may be helpful.<sup>42-44</sup> Because of the lack of evidence of efficacy, classroom or school-wide screening should be strongly discouraged.

It would be prudent to periodically provide information to families of all children on the diagnosis, treatment, and prevention of head lice. Parents should be encouraged to check their children's heads for lice if the child is symptomatic; school screenings do not take the place of these more careful checks.<sup>5,44-46</sup> It may be helpful for the school nurse or other trained persons to check a student's head if he or she is demonstrating symptoms.

### Management on the Day of Diagnosis

Because a child with an active head lice infestation has likely had the infestation for a month or more by the time it is discovered, poses little risk to others, and does not have a resulting health problem, he or she should remain in class but be discouraged from close direct head contact with others. If a child is assessed as having head lice, confidentiality must be maintained so the child is not embarrassed. The child's parent or guardian should be notified that day by telephone or a note sent home with the child at the end of the school day stating that prompt, proper treatment of this condition is in the best interest of the child and his or her classmates. Common sense should prevail when deciding how "contagious" an individual child may be (a child with hundreds versus a child with 2 live lice). It may be prudent to check other children who were most likely to have had direct head-to-head contact with the index child. In an elementary school, often the most efficient way to deal with the problem is to notify the parents or guardians of all children in the index child's classroom, encouraging that all children be checked at home and treated if appropriate before returning to school the next day.

### Criteria for Return to School

A child should be allowed to return to school after proper treatment. Some schools have had "no nit"

policies under which a child was not allowed to return to school until all nits were removed. The American Academy of Pediatrics and the National Association of School Nurses ([www.nasn.org/positions/nitfree.htm](http://www.nasn.org/positions/nitfree.htm)) discourage such policies. However, nit removal at the time of treatment by the parent or guardian may be considered for the following reasons:

- Nit removal may decrease diagnostic confusion.
- Nit removal may decrease the possibility of unnecessary retreatment.
- Some experts recommend removal of nits within 1 cm of the scalp to decrease the small risk of self-reinfestation.

The school nurse, if present, can perform a valuable service by rechecking a child's head if requested to do so by a parent. In addition, the school nurse can offer extra help to families of children who are repeatedly or chronically infested. In rare instances, it may be helpful to make home visits or involve public health nurses to ensure that treatment is being conducted effectively. No child should be allowed to miss valuable school time because of head lice. Numerous anecdotal reports exist of children missing weeks of school and even being forced to repeat a grade because of head lice.<sup>1,2,7,45</sup>

#### Reassurance of Parents, Teachers, and Classmates

The school can be most helpful by making available accurate information on diagnosis, treatment, and prevention of head lice to the entire school community in an understandable form. Information sheets in different languages and visual aids for families with limited language skills should be developed by schools and/or local health departments. If pediatricians and schools take the lead in reacting in a calm manner, parents will be able to focus on appropriate treatment without getting unduly upset.

#### Child Care and "Sleep Over" Camps

Little information is available on the incidence and control of head lice outside of the school-aged population and outside of school. Because head lice are most readily transmitted by direct head-to-head contact, child care centers and camps where children share sleeping quarters may allow for easier spread. Therefore, it may be prudent to establish stricter criteria than in the school-based setting for identifying and treating others in these special settings once an index case is identified.

#### SUMMARY OF KEY POINTS

1. Pediatricians should be knowledgeable about head lice infestations and treatments and should be available as information resources for families, schools, and other community agencies.
2. School personnel involved in detection of head lice infestation should be appropriately trained. The importance and difficulty of correctly diagnosing an active head lice infestation should be acknowledged. Schools should examine any lice related policies they may have with this in mind.

3. Permethrin 1% (Nix) is currently the recommended treatment for head lice, with retreatment in 7 to 10 days if live lice are seen. Instructions on proper use of products should be carefully relayed. Safety and efficacy should be taken into account when recommending any product for treatment of head lice infestation.
4. None of the currently available pediculicides are 100% ovicidal and resistance has been reported with lindane, pyrethrins, and permethrin. Treatment failure does not equate with resistance, and most instances of such failure represent misdiagnosis/misidentification or noncompliance with the treatment regimen.
5. Head lice screening programs have not been proven to have a significant effect on the incidence of head lice in the school setting over time and are not cost-effective. Parent education programs may be helpful in the management of head lice in the school setting.
6. Manual removal of nits after treatment with a pediculicide is not necessary to prevent spread. In the school setting, removal may be considered to decrease diagnostic confusion.
7. No healthy child should be excluded from or allowed to miss school time because of head lice. "No nit" policies for return to school should be discouraged.

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## REFERENCES

- Meinking T, Taplin D. Infestations. In: Schachner LA, Hansen RC, eds. *Pediatric Dermatology*. 2nd ed. New York, NY: Churchill Livingstone; 1995:1347–1392
- Meinking TA. Infestations. *Curr Probl Dermatol*. 1999;11:73–120
- Gratz NG. *Human Lice: Their Prevalence, Control and Resistance to Insecticides: A Review, 1985–1997*. Geneva, Switzerland: World Health Organization, Division of Control of Tropical Diseases, WHO Pesticide Evaluation Scheme; 1997:8
- Chunge RN, Scott FE, Underwood JE, Zavarella KJ. A review of the epidemiology, public health importance, treatment and control of head lice. *Can J Public Health*. 1991;82:196–200
- Chunge RN, Scott FE, Underwood JE, Zavarella KJ. A pilot study to investigate transmission of head lice. *Can J Public Health*. 1991;82:207–208
- Maunder JW. Human lice: some basic facts and misconceptions. *Bull Pan Am Health Org*. 1985;19:194–197
- Pollack RJ, Kiszewski AE, Spielman A. Overdiagnosis and consequent mismanagement of head louse infestations in North America. *Pediatr Infect Dis J*. 2000;19:689–693
- Rasmussen JE. Pediculosis: treatment and resistance. *Adv Dermatol*. 1986;1:109–125
- Chesney PJ, Burgess IF. Lice: resistance and treatment. *Contemp Pediatr*. 1998;15:181–192
- Meinking TL, Taplin D, Kalter DC, Eberle MW. Comparative efficacy of treatments for pediculosis capitis infestations. *Arch Dermatol*. 1986;122:267–271
- Burgess IF, Peock S, Brown CM, Kaufman J. Head lice resistant to pyrethroid insecticides in Britain [letter]. *BMJ*. 1995;311:752
- Abramowicz M, ed. Drugs for parasitic infections. *Med Lett Drugs Ther*. 1995;37:99–108
- Abramowicz M, ed. Drugs for head lice. *Med Lett Drugs Ther*. 1997;39:6–7
- Vander Stichele RH, Dezeure EM, Bogaert MG. Systematic review of clinical efficacy of topical treatments for head lice. *BMJ*. 1995;311:604–608
- Hansen RC, and Working Group on the Treatment of Resistant Pediculosis. Guidelines for the treatment of resistant pediculosis. *Contemp Pediatr*. 2000;17(suppl):1–10
- Mumcuoglu KY, Hemingway J, Miller J, et al. Permethrin resistance in the head louse *Pediculus capitis* from Israel. *Med Vet Entomol*. 1995;9:427–432, 447
- Rupes V, Moravec J, Chmela J, Ledvinka J, Zelenkova J. A resistance of head lice (*Pediculus capitis*) to permethrin in Czech Republic. *Centr Eur J Public Health*. 1995;3:30–32
- Pollack RJ, Kiszewski A, Armstrong P, et al. Differential permethrin susceptibility of head lice sampled in the United States and Borneo. *Arch Pediatr Adolesc Med*. 1999;153:969–973
- Tenenbein M. Seizures after lindane therapy. *J Am Geriatr Soc*. 1991;39:394–395
- Fischer TF. Lindane toxicity in a 24-year-old woman. *Ann Emerg Med*. 1994;24:972–974
- Shacter B. Treatment of scabies and pediculosis with lindane preparations: an evaluation. *J Am Acad Dermatol*. 1981;5:517–527
- Rasmussen JE. The problem of lindane. *J Am Acad Dermatol*. 1981;5:507–516
- Kucirka SA, Parish LC, Witkowski JA. The story of lindane resistance and head lice. *Int J Dermatol*. 1983;22:551–555
- Burgess IF. Human lice and their management. *Adv Parasitol*. 1995;36:271–342
- Taplin D, Castillero PM, Spiegel J, Mercer S, Rivera AA, Schachner L. Malathion for treatment of *Pediculus humanus* var *capitis* infestation. *JAMA*. 1982;247:3103–3105
- Karacic I, Yawalker SJ. A single application of crotamiton lotion in the treatment of patients with pediculosis capitis. *Int J Dermatol*. 1982;21:611–613
- Shashindran CH, Gandhi IS, Krishnasamy S, Ghosh MN. Oral therapy of pediculosis capitis with cotrimoxazole. *Br J Dermatol*. 1978;98:699–700
- Hipolito RB, Mallorca FG, Zuniga-Macaraig ZO, Apolinario PC, Wheeler-Sherman J. Head lice infestation: single drug versus combination therapy with one percent permethrin and trimethoprim/sulfamethoxazole. *Pediatrics*. 2001;107(3). Available at: <http://www.pediatrics.org/cgi/content/full/107/3/e30>
- Glaziou P, Nyguyen LN, Moullia-Pelat JP, Cartel JL, Martin PM. Efficacy of ivermectin for the treatment of head lice (*Pediculus capitis*). *Trop Med Parasitol*. 1994;45:253–254
- Burkhart KM, Burkhart CN, Burkhart CG. Our scabies treatment is archaic, but ivermectin has arrived [letter]. *Int J Dermatol*. 1998;37:76–77
- Burkhart CN, Burkhart CG. Another look at ivermectin in the treatment of scabies and head lice [letter]. *Int J Dermatol*. 38:235, 1999
- Schachner LA. Treatment resistant head lice: alternative therapeutic approaches. *Pediatr Dermatol*. 1997;14:409–410
- Burkhart CN, Burkhart CG, Pchalek I, Arbogast J. The adherent cylindrical nit structure and its chemical denaturation in vitro: an assessment with therapeutic implications for head lice. *Adolesc Med*. 1998;152:711–712
- Ibarra J, Hall DM. Head lice in school children. *Arch Dis Child*. 1996;75:471–473
- Bainbridge CV, Klein GL, Neibart SI, et al. Comparative study of the clinical effectiveness of a pyrethrin-based pediculicide with combing versus a permethrin-based pediculicide with combing. *Clin Pediatr (Phila)*. 1998;37:17–22
- Burkhart CN, Arbogast J. Head lice therapy revisited [letter]. *Clin Pediatr (Phila)*. 37:395, 1998
- Maunder JW. Updated community approach to head lice. *J R Soc Health*. 1988;108:201–202
- Monheit BM, Norris MM. Is combing the answer to head lice? *J Sch Health*. 1986;56:158–159
- O'Brien E. Detection and removal of head lice with an electronic comb: zapping the louse! *J Pediatr Nurs*. 13:265–266, 1998
- DeFelice J, Rumsfield J, Bernstein JE, Roshal JY. Clinical evaluation of an after-pediculicide nit removal system. *Int J Dermatol*. 1989;28:468–470
- Williams LK, Reichert A, MacKenzie WR, Hightower AW, Blake PA. Lice, nits, and school policy. *Pediatrics*. 2001;107:1011–1015
- Mathias RG, Wallace JF. Control of head lice: using parent volunteers. *Can J Public Health*. 1989;89:461–463
- Clore ER, Longyear LA. Comprehensive pediculosis screening programs for elementary schools. *J Sch Health*. 1990;60:212–214
- Donnelly E, Lipkin J, Clore ER, Altschuler DZ. Pediculosis prevention and control strategies of community health and school nurses: a descriptive study. *J Community Health Nurs*. 1991;8:85–95
- Brainerd E. From eradication to resistance: five continuing concerns about pediculosis. *J Sch Health*. 1998;68:146–150
- Clore ER. Dispelling the common myths about pediculosis. *J Pediatr Health Care*. 1989;3:28–33

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