

Head lice infestations: A clinical update



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Head lice (*Pediculus humanus capitis*) infestations remain a pesky communicable problem, particularly in school-age children in Canada and elsewhere (1,2). A small 2003 population-based study (3) of primary school children in the United Kingdom noted a 2% prevalence and a 37% annual incidence of head lice.

Unlike body lice, head lice are not a health hazard, a sign of poor hygiene or a vector for disease, but are more a societal issue (2).

The present statement updates the 2004 statement (4), and highlights changes in head lice treatment products available in Canada, reports treatment failures, and reviews recent studies that provide evidence and rationale for management recommendations.

THE AGENT

Head lice are wingless, 2 mm to 4 mm long (adult louse), six-legged, blood-sucking insects that live on the scalp of humans (5). Infested children usually carry fewer than 20 mature head lice (more commonly, less than 10 head lice), each of which, if untreated, live for three to four weeks (6-8). Head lice stay close to the scalp for food, warmth, shelter and moisture (7,8). The head louse feeds every 3 h to 6 h by sucking blood and simultaneously injecting saliva. After mating, the adult female louse can produce five to six eggs per day for 30 days (9), each in a shell (a nit) that is 'glued' to the hair shaft near the scalp (6,7). The eggs hatch nine to 10 days later into nymphs that molt several times over the next nine to 15 days to become adult head lice (6). The hatched empty eggshells (nits) remain on the hair, but are not a source of reinfestation. Nymphs and adult head lice can survive for up to three days away from the human host (9). While eggs can survive away from the host for up to three days, they require the higher temperature found near the scalp to hatch (8).

THE INFESTATION

An infestation with lice is called pediculosis, and usually involves less than 10 live lice (8). Itching occurs if the individual becomes sensitized to antigenic components of louse saliva that is injected as the louse feeds (2,8). On the first infestation, sensitization commonly takes four to six weeks (8,10). However, some individuals remain asymptomatic and never itch (8). In cases with heavy infestations, secondary bacterial infection of the excoriated scalp may occur. Unlike body lice, head lice are not vectors for other diseases (8,10).

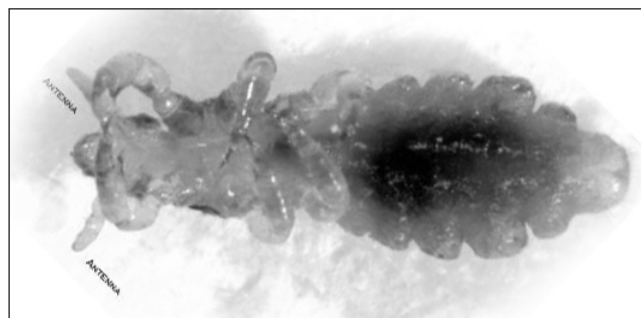


Figure 1) An adult louse measures 2 mm to 4 mm in length. Reproduced with permission from reference 31

TRANSMISSION OF HEAD LICE

Head lice are spread mainly through direct head-to-head (hair-to-hair) contact (10,11). Lice do not hop or fly, but can crawl at a rapid rate (23 cm/min under natural conditions) (9). There continues to be controversy about the role fomites play in transmission (9). Two studies from Australia suggest that in the home, pillowcases present only a small risk (1), and in the classroom, the carpets pose no risk (12). Pets are not vectors for human head lice (3).

DIAGNOSIS

The definitive diagnosis of head lice infestation requires the detection of a living louse (2,7,10) (Figure 1). The presence of nits indicate a past infestation that may not be currently active.

Because head lice can move quickly, their detection requires expertise and experience. An Israeli study (13) with experienced parasitologists noted that combing with a fine-toothed lice comb was four times more effective and twice as fast as direct visual examination for the detection of live head lice, and hence, for the diagnosis of head lice infestations.

Pollack et al (14) also found that expertise is key to diagnosis. They documented that health care providers and lay personnel frequently overdiagnosed and misdiagnosed pediculosis (14). Many failed to distinguish active from extinct infestations, particularly if they were relying only on nit detection. School nurses were particularly adept at spotting nits, but appeared to lack the expertise, equipment, time and inclination to distinguish active from inactive infestations. A viable nit is more likely to be found close to the scalp (less than 0.6 cm away) (15). On microscopy, a

TABLE 1
Topical treatments of head lice infestations

Insecticides	Trade name	Active ingredient	Method of use in brief	Areas of concern
Pyrethrins				
Resistance documented in Czech Republic, Argentina, France, Israel and United Kingdom (5)	R&C Shampoo + Conditioner*	Pyrethrin plus piperonyl butoxide Made from natural extracts from chrysanthemums Neurotoxic to lice, but very low toxicity to humans	<ul style="list-style-type: none"> • Apply to dry hair that does not have conditioner, gels, creams, etc, on it • Soak with minimum of 25 mL • Let sit 10 min • Add small amount of water to form lather and work into hair • Rinse well with cool water, minimizing body exposure • Repeat treatment seven to 10 days later 	<ul style="list-style-type: none"> • True allergic reactions are rare • Possible allergic reactions if allergic to ragweed • May cause itching or mild burning sensation of scalp[†]
Permethrin				
Resistance documented in Czech Republic, Argentina, France, Israel, United Kingdom and United States (5,18)	Kwellada-P Creme Rinse* Nix Creme Rinse [‡]	1% permethrin (synthetic pyrethroid) Neurotoxic to lice, but very low toxicity to humans	<ul style="list-style-type: none"> • After washing hair with conditioner-free shampoo, rinse, towel dry • Apply enough permethrin creme rinse to saturate hair and scalp • Leave on for 10 min • Rinse well with cool water, minimizing body exposure • Towel dry • Repeat in seven days[†] 	<ul style="list-style-type: none"> • Does not cause allergic reactions • May cause itching or mild burning sensation of scalp[†]
Lindane				
Resistance documented in England, Netherlands and Panama (5,19)	Hexit Shampoo [§] PMS-Lindane Shampoo [¶]	1% lindane (gamma benzene hexachloride) An organochloride with properties similar to DDT Very neurotoxic to lice but also to humans	<ul style="list-style-type: none"> • Apply to dry hair that does not have conditioner, gels, creams, etc, on it • Apply this shampoo over a sink to minimize body exposure • Apply minimum amount to thoroughly wet hair and scalp • Rub shampoo into hair and scalp, allow to remain in place for 4 min, use just enough water to form a good lather • Rinse thoroughly with cool water minimizing body contact and dry with a clean towel • Repeat in seven to 10 days 	<ul style="list-style-type: none"> • Possible neurotoxicity, including seizures • Possible anemia • Contraindicated if there is a history of seizures • Occasional irritation of scalp[†] • Not recommended for infants, young children, pregnant and nursing mothers
Noninsecticide				
Myristate/cyclomethicone solution	Resultz rinse**	50% isopropyl myristate and 50% ST-cyclomethicone Dissolves the waxy exoskeleton of the louse, leading to dehydration and death of the louse	<ul style="list-style-type: none"> • Use a towel to prevent contact with eyes and to keep clothes dry. Keep eyes closed throughout the process including the 10 min wait time • Thoroughly apply to dry hair and scalp • 30 mL to 60 mL for short hair, 60 mL to 90 mL for shoulder-length hair, 90 mL to 120 mL for long hair • Allow product to remain on hair and scalp for 10 min • Rinse off with warm water • Repeat in 7 days 	<ul style="list-style-type: none"> • May cause local irritation • Not recommended for infants or children younger than four years of age • If contact with eyes, flush well with water immediately

*GlaxoSmithKline Consumer Healthcare, Canada; [†]Itching and burning sensation of the scalp, which occurs following treatment, does not necessarily indicate reinfestation and need for retreatment. If bothersome, topical steroids and antihistamines may be helpful (9); [‡]Insight Pharmaceuticals, Canada; [§]Odan Laboratories Ltd, Canada; [¶]Pharmascience Inc, Canada (according to the Compendium of Pharmaceuticals and Specialties 2000. Ottawa: Canadian Pharmacists Association, 2000); **Nycomed Canada Inc. DDT Dichlorodiphenyltrichloroethane

viable nit can be seen as intact and containing a well-hydrated mass or a discernibly developing embryo (14). However, without the ability to distinguish potentially viable from nonviable nits, conclusions on the potential for active infestation by nit detection alone are not reliable (14).

Finding nits close to the scalp is, at best, only a modest predictor of possible active infestation. While a study in Georgia, USA (15), found that having five or more nits within 0.6 cm of the scalp was a risk factor for becoming infested with active lice, this occurred in fewer than 32% of such children (15). For children with fewer than five nits close to the scalp, only 7% became actively infested. Hence, having nits close to the scalp does not necessarily indicate that a live lice infestation has occurred or will occur.

TREATMENT

Well-established treatment options for proven head lice infestation, include topical insecticides, oral agents and wet combing. A new noninsecticidal product has recently been approved by Health Canada.

Topical insecticides

Table 1 presents a list of the topical insecticides (pyrethrins, permethrin 1% and lindane) currently available for the treatment of head lice infestations in Canada, their active ingredients, methods of use and areas of concern. Malathion lotion (0.5%) and crotamiton lotion (10%) are not available in Canada.

The most recent Cochrane review (16) noted that only three studies of treatment of head lice with topical insecticides met appropriate inclusion criteria (two placebo-controlled studies and one comparative clinical field study). On the basis of these three trials, the review concluded that permethrin, malathion and synergized pyrethrins (ie, pyrethrin with piperonyl butoxide) proved to be effective (16).

None of these three topical insecticides (pyrethrin, permethrin and lindane) are 100% ovicidal; thus, reapplication seven to 10 days later is generally recommended (10).

Toxicity of topical insecticides: Both pyrethrins and permethrin have favourable safety profiles with minimal percutaneous absorption (6). To minimize body exposure to a topical insecticide following application to the scalp, rinse well using cool water taking care to avoid unnecessary skin exposure to the product – do not sit the child in the bath water as the hair is being rinsed.

Lindane is considered to be a second-line therapy because of the potential for neurotoxicity and bone marrow suppression following percutaneous absorption (6,17). The Food and Drug Administration (17) has issued an advisory concerning the use of lindane-containing products for the treatment of lice and scabies. Neurological side effects have been reported in patients using lindane correctly, although most serious outcomes, including death and hospitalizations, occurred after multiple applications or oral ingestion. A safe interval for the reapplication of lindane has not been established (17). Topical lindane for treatment of head lice

is not recommended for use in infants, young children, pregnant and nursing mothers (17). Special care should be taken to ensure that the package directions are carefully followed. On an additional note, pharmaceutical use of lindane has been banned in California since 2002 based on concerns about contamination of waste water with lindane. A follow-up study of waste water from California published in 2008 showed a marked reduction of lindane levels compared with levels before the ban (18).

Resistance to topical insecticides: Resistance has been reported with pyrethrins, permethrin and lindane in a number of countries (Table 1) (6,19). While some resistance to permethrin has been documented in the United States, resistance to other topical agents has not been proven (20). In the United Kingdom, resistance can be a problem (2,21). The resistance rates in Canada are unknown because formal studies have not been performed. A number of other diagnoses should be ruled out before resistance is considered (10,14):

- misdiagnosis and overdiagnosis (diagnosis requires detection of live lice before treatment);
- poor compliance with instructions for proper application of the topical insecticide, lack of secondary application or reapplication too soon after first application; and
- new infestation acquired after treatment.

Of particular note, itching occurring post-treatment with a topical insecticide does NOT mean that a reinfestation has occurred. Application of an approved topical insecticide to the scalp can cause rash, itching and mild burning (6). The diagnosis of a reinfestation requires the detection of live lice. If the post-treatment itching is bothersome, topical steroids and/or antihistamines may help to provide relief (10).

Oral agents

Data to support the use of oral agents for the treatment of head lice are limited.

Although trimethoprim-sulfamethoxazole has been used in a randomized trial (22) to treat head lice, both alone and in combination with topical permethrin, concerns have been raised about the diagnostic criteria used in the trial and the potential for promoting bacterial resistance and further reducing the value of this drug in other settings if this practice becomes widespread (20). There are no published large trials. This is not an approved use of trimethoprim-sulfamethoxazole in Canada.

There are reports (2) regarding the oral (and topical) use of ivermectin, an antihelminthic agent for the treatment of head lice. Treatment consists of two single oral doses, 200 µg/kg spaced seven to 10 days apart. Ivermectin is potentially neurotoxic and should not be used in children who weigh less than 15 kg (10). This drug is available in Canada only through special access programs (23).

Wet combing

There is little evidence in support of wet combing as a primary treatment for head lice (24,25). In a randomized trial of 4037 school children in Wales, United Kingdom (24), mechanical removal of lice through combing of wet hair with a fine-toothed comb every three to four days for two weeks was compared with two applications of topical 0.5% malathion lotion seven days apart (24). Wet combing resulted in a cure (no detection of live lice after two weeks) in 38%, while the malathion treatment resulted in a cure in 78% (24). In another study (24), the addition of wet combing to the topical 1% permethrin treatment protocol did not improve the efficacy of permethrin treatment alone when assessed at days 2, 8, 9 and 15 (combing 72.7%, no combing 78.3%). While vinegar has been suggested as a home remedy to aid wet combing, there are no studies showing its benefit.

Other treatments

Health Canada has recently approved the use of a new non-insecticidal product containing isopropyl myristate 50% and ST-cyclomethicone 50% (Resultz, Nycomed Canada Inc) for the treatment of head lice in children four years of age and older. The agent works by dissolving the waxy exoskeleton of the louse, leading to dehydration and death. The product is applied to a dry scalp, and rinsed off in 10 min. This product is not ovicidal, and thus a second application in one week is recommended. Several small phase II trials (200 to 300 participants only) have demonstrated efficacy and minimal side effects, the most common being mild erythema and pruritis of the scalp (26-29). Phase III trials are ongoing.

A number of household products, such as mayonnaise, petroleum jelly, olive oil, tub margarine and thick hair gel, have been suggested as treatment for head lice. Application of a thick coating of such agents to the hair and scalp left on overnight will theoretically occlude lice spiracles and decrease respiration (6). However, these products show little killing of lice and are less effective than topical insecticides (8). There are no published trials on the safety or efficacy of these home remedies.

Other products such as gasoline or kerosene are flammable, toxic and dangerous.

While a number of 'natural' agents, such as tea tree oil and aromatherapy, have been used for the treatment of head lice, efficacy and toxicity data are not available for these agents (7,8). One small study in Israel (30) noted that a natural product, which contained coconut oil, anise oil and ylang ylang oil, applied to hair three times at five-day intervals, was as successful as the control pediculicide.

Products intended for treating lice in animals are not recommended for human use.

SCHOOL AND DAYCARE HEAD LICE AND NIT POLICIES

Exclusion from school and daycare due to the detection of the presence of 'nits' does not have sound medical rationale. Even the detection of active head lice should not lead to the exclusion of the affected child. Treatment should be recommended

and close head-to-head contact should be discouraged pending treatment. The American Academy of Pediatrics and the Public Health Medicine Environmental Group in the United Kingdom also discourage 'no nit' school policies (2,9).

Families of children in the classroom where a case of active head lice has been detected should be alerted that an active infestation has been noted, and informed about the diagnosis, misdiagnosis and management of head lice, and the lack of risk for serious disease.

ROLE OF ENVIRONMENTAL DECONTAMINATION

Data on whether disinfection of personal, school or household items decreases the likelihood of reinfestation are lacking (11,12). As noted, head lice do not live far away from the scalp, and nits are unlikely to hatch at room temperature (8,9). Hence, excessive cleaning is not warranted. At most, the cleaning of items in prolonged or intimate contact with the head (eg, hats, pillowcases, brushes and combs) may be warranted. Washing the item in hot water (66°C), drying it in a hot dryer for 15 min or storing it in an occlusive plastic bag for two weeks will kill lice and nits (8,11).

ROLE OF HEALTH CARE PROVIDERS

Given the prevalence of infestations, the notoriety and high anxiety levels that a diagnosis of head lice in school children can generate in parents and/or teachers, health care providers need to ensure that head lice myths are dispelled and that accurate information is provided (2). Parents and teachers need to be informed that head lice infestations are common, may be asymptomatic, are not a sign of uncleanliness and are not a vector for serious medical diseases. Information on optimizing diagnosis and minimizing misdiagnosis, and appropriate management strategies if a case is diagnosed, need to be provided.

SUMMARY

- Head lice infestations are common in school children but are not associated with serious disease and are not a sign of poor hygiene.
- Head lice infestations can be asymptomatic for weeks.
- Misdiagnosis of head lice infestations is common. The diagnosis requires detection of live head lice. Detection of nits alone does not indicate active infestation.
- Treatment with an approved, properly applied, topical head lice insecticide (two applications seven to 10 days apart) is recommended when a case of active infestation is detected. Contacts of cases in which head-to-head touching may have occurred merit examination to detect active infestation and, if present, treatment.
- Scalp itchiness can occur following application of a topical insecticide and does not indicate that resistance to treatment or a reinfestation has occurred.

Diagnosis of an active reinfestation requires detection of live lice.

- Topical insecticides, especially lindane, can be toxic, particularly if misused. Care should be taken to avoid unnecessary exposure and, when indicated, to minimize skin contact beyond the scalp.
- 'No nit' school exclusion policies lack a rational medical basis and are not recommended.
- Excessive household or school cleaning is not warranted following the detection of a case of head lice because neither head lice nor nits survive for an extended period of time away from the scalp.
- While resistance to topical agents has been noted in other countries, this does not appear to be as large a problem in North America.

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The recommendations in this statement do not indicate an exclusive course of treatment or procedure to be followed.

Variations, taking into account individual circumstances, may be appropriate.

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