

PEDIATRIC PHARMACOLOGY

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**Pharmacotherapy of Head Lice in Children:
 ■ An Update ■**

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Head lice infestation is a common problem among young children, and it appears that the incidence is increasing (Gratz, 1973; Rasmussen, 1984). Because of the lack of a nationwide reporting system, the extent of the problem is difficult to estimate for the United States as a whole, but investigations in New York, Georgia, and Florida schools revealed an overall rate of infestation of 10% for girls and 7% for boys (Juranek, 1977). The head louse dwells on the external surface rather than within a host, does not result in multiplication of parasitic organisms within the body, and does not transmit disease to man; thus the presence of head lice is an infestation rather than an infection. However, irritation with subsequent scratching of infested areas can lead to secondary bacterial infection (Gratz, 1973; Gurevitch, 1985). Head lice may cause more psychological than physical distress for both parents and children, evoking feelings of shame and disgust.

The head louse (*Pediculus humanus var capitis*) is a gray-white wingless insect (arthropod) with six legs and is 2 to 3 mm long. It is an exclusively human parasite that cannot survive more than 2 to 10 days away from its host (Brown & Neva, 1983; Canadian Pediatric Society, 1985; Rasmussen, 1985). The average number of head lice on the infested host ranges from 12 to 24. The adult female lice lay eggs within a few days of fertilization, depositing four to six per day near the base of the hair shaft. These white eggs (nits) are cemented to the hair shaft and will hatch in 4 to 14 days at body temperature. They mature through three nymphal stages within 2 weeks. As adult lice they will live an average of 30 days (Beaver, Jung, & Cupp, 1984). They are most commonly spread by hair-to-hair contact, but also when fomites such as hats, hooded coats, ski masks, and scarves are in contact with noninfested clothing in school closets or lockers. Lice may also be transmitted through bed linen, towels, and pillows, as well as hair brushes and combs. Crowding, large family size, sharing of beds and toilet articles, and poor hygiene all result in more rapid transmission.

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■ TABLE 1 Comparative trials of permethrin and lindane

REFERENCE	NUMBER OF PATIENTS			% LOUSE-FREE AT 7 DAYS		
	PERMETHRIN	LINDANE	PLACEBO	PERMETHRIN	LINDANE	PLACEBO
Bowerman et al., 1987*	195	99	—	99	90	—
Brandenburg et al., 1986*	257	251	—	99.6	91.9	—
Taplin et al., 1986†	29	30	34	100	67	9

*Randomized, single-blinded (investigator-blinded) trial; differences significant at both 7 and 14 days ($p < 0.001$).

†Randomized, double-blinded trial for permethrin vs placebo; lindane group nonrandomized (and only investigator-blinded) so statistical analysis not performed.

■ MANAGEMENT

Once the diagnosis of pediculosis capitis is confirmed by the identification of living lice on the scalp or nits attached to the hair, it is important to both treat the patient promptly and prevent the spread of lice. Preventive measures include examining all other family members (even if asymptomatic), and treating if infestation is present. Clothing or bed linen that has been contaminated by the patient and any other infested family members within the past two days should be thoroughly washed and dried by machine (hot cycle in each) or dry cleaned. If the infested child is attending school, the school nurse should be notified so that classmates can be examined for infestation.

Currently there are several effective agents for the treatment of head lice, including the firstline agents lindane and pyrethrins, which have been available for many years; and permethrin, which was introduced in early 1986. The following discussion will be limited to preparations available in the United States.

Pharmacotherapy

Lindane (gamma benzene hydrochloride). Lindane is usually considered the treatment of choice for head lice, although there is some controversy concerning its potential toxicity and suboptimal ovicidal activity (Altschuler, 1986). It is available by prescription in a 1% concentration as a shampoo, lotion, and cream (Kwell, Scabene). The shampoo is the preferred formulation because of the short exposure time needed. The manufacturer recommends applying a sufficient quantity (1 ounce for short, 1½ ounces for medium length, and 2 ounces for long hair) to dry hair, forming a good lather with small quantities of water, and leaving it on for 4 minutes before rinsing. After towel drying, the hair should be combed with a fine tooth comb to remove any remaining nits. Others have suggested that a 10-minute exposure time is more effective (Lane, 1987; Rasmussen, 1984). Combing

the nits out of the hair after shampooing may be important to lindane efficacy, since there is evidence to suggest lindane has only fair to moderate ovicidal activity. In one in vitro study, 30% of lindane-treated nits produced viable nymphs; in a subsequent clinical trial conducted by the same investigators, 57% of the eggs hatched despite lindane treatment (Meinking, Taplin, Kalter, & Eberle, 1986).

A common concern about lindane use in children is its potential toxicity. Lindane is a chlorinated hydrocarbon originally developed as an agricultural insecticide. When used as directed for head lice, lindane has been found to be a safe pediculocide on the basis of more than 20 years of experience. Scalp irritation, erythema, pruritis, and other dermal reactions may occur, but no serious adverse reactions have been reported when used appropriately (Rasmussen, 1984; Schacter, 1981). However, total body application of lindane in excessive amounts or for a prolonged period for scabies, or accidental ingestion can produce central nervous system stimulation with seizures. Even after application of 1% lindane shampoo for head lice, measurable concentrations in blood were present in nine children. Four of these patients, who were treated again after 5 days because of the presence of living lice, had blood concentrations of lindane that were two- to three-fold higher than those observed in patients who received one application (Ginsburg & Lowry, 1983). Since accumulation of lindane can occur even with application to the scalp, it is prudent to minimize the degree of exposure. A second application is indicated only if living lice or viable nits are present 7 days after treatment (Ginsburg & Lowry, 1983; Gurevitch, 1985).

Pyrethrins with piperonyl butoxide. Pyrethrins are purified derivatives from flowers that belong to the chrysanthemum family and have been known as effective pediculocides for 40 years. They have gained more attention in recent years because of controversy surrounding lindane toxicity. Piperonyl butoxide is incorporated into pyrethrin preparations because it potentiates the insecticidal effect of pyrethrins by inhibiting the latter's metabolism in arthropods. Shampoos, solutions, and gels containing 0.17% to 0.33% pyrethrins with 2% to 4% piperonyl butoxide (Rid, A-200 Pyrinat, R & C) are available without prescription. Application is similar to that described for lindane, with a 10-minute exposure time recommended. Combing out of nits is advised; similar to lindane, there is evidence to suggest that ovicidal activity is not complete (Meinking et al., 1986). The pyrethrins/piperonyl butoxide preparations are equal in efficacy to lindane and may be the least toxic avail-

% LOUSE-FREE AT 14 DAYS		
PERMETHRIN	LINDANE	PLACEBO
98	76	—
99.2	85.2	—
97	43	6

■ TABLE 2 Cost comparison of pediculocides

PRODUCT	AVERAGE WHOLESALE PRICE (2 OZ.)
Permethrin (Nix, Burroughs-Wellcome)	\$8.40
Lindane	
Kwell shampoo, Reed & Carnrick	\$4.85
Generic shampoo	\$3.08
Pyrethrins with piperonyl butoxide	
RID, Leeming/Pacquin	\$4.19
A-200 Pynrate liquid, Norcliff Thayer	\$4.01
R & C liquid, Reed & Carnrick	\$4.14

From the *Drug Topics Redbook*, 1987.

able pesticide (Gurevitch, 1985; Meinking et al., 1986; Rasmussen, 1984). However, since the vehicle for most of these preparations contains petroleum distillates, these agents can be especially irritating to the scalp.

Permethrin. Permethrin (Nix) is a new pediculocide belonging to the chemical class of insecticides known as pyrethroids. Pyrethroids have increased insecticidal potency and light stability compared with the parent molecule, pyrethrin. Permethrin is available in a 1% concentration as a creme rinse. The manufacturer recommends that the hair first be washed with shampoo, rinsed with water, and towel dried. Then a sufficient amount of the preparation is applied to saturate the hair and scalp, left on the hair for 10 minutes, then rinsed with water. Of note is the manufacturer's statement that combing out the nits is not required for therapeutic efficacy. Herein lies the potential advantage of permethrin over lindane and pyrethrins: increased ovicidal activity. Taplin, Meinking, Castillero, and Sanchez (1986) compared the ovicidal activity of permethrin, placebo, and lindane by observing the proportion of nits that hatched into active nymphs; the percentage of nits hatched was 30%, 86%, and 55%, respectively. The superior ovicidal activity of permethrin over lindane is also suggested by several clinical trials where both products were used according to manufacturers' instructions, except that nits were not combed out of the hair. In each of the trials the percentage of patients who were louse-free at 7 and 14 days after treatment was highest in the permethrin group (Table 1).

Adverse effects consist of mild dermal reactions similar to those observed with other preparations. Pruritis may occur as a result of head lice infestation itself but may worsen after treatment with permethrin in up to 6% of patients. Other signs and symptoms that have been reported (in order of decreasing frequency) include: burning/stinging, erythema, tingling, edema, pain, and rash of the scalp (Brandenburg, Deinard, DiNapoli, Englander, Orthofer, & Wagner, 1986). Numbness of the scalp has also been reported (Bowerman, Gomez, Austin, & Wold, 1987). Brandenburg et al. (1986) observed no significant differences between permethrin and lindane in the incidence of these reactions.

Crotamiton. This product is approved by the Food and Drug Administration solely for the treatment of scabies, and this is its primary use. However, it has also been shown in one study to be an effective pediculocide (Karacic & Yawalkar, 1982). When crotamiton as a 10% lotion (Eurax) was rubbed through the hair and scalp, then left on for 24 hours, 7 days after treatment 96% of 49 patients were louse-free. Until more experience is gained with this product as a pediculocide, it should not be considered as first-line therapy. Although crotamiton, in the treatment of scabies, is recommended as a safe alternative to lindane in infants, young children, and pregnant or lactating women, little is known about percutaneous absorption and potential toxicity in children or in the developing fetus (Rasmussen, 1984).

Recommendations. When used as directed the prescription medications lindane and permethrin as well as the over-the-counter (OTC) pyrethrins are all safe and effective, with similar side effects. There is some evidence to suggest that permethrin may be more effective than lindane if nits are not combed out after treatment. Therefore, if it is suspected that the child or his caretaker will not follow directions to comb out nits, permethrin may be the drug of choice. Permethrin is also the most expensive of the pediculocides (Table 2). If compliance with combing out nits is expected, the least expensive products—generic lindane shampoo or the OTC pyrethrins—are recommended. The OTC pyrethrin preparations offer the added convenience of a specially designed comb for nit removal.

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