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Drugs for Head Lice

Head lice infestation occurs in all age groups, but especially in elementary school children. In most cases, transmission occurs by head-to-head contact.[1]

Table 1. Recommendations

Treatment
▶ Patients with live lice should be treated.
▶ Permethrin 1% and pyrethrins are available OTC and are inexpensive, but resistance is widespread.
▶ FDA-approved topical formulations of benzyl alcohol, malathion, spinosad, and ivermectin are preferred.
▶ Retreatment may be necessary because none of the available products are 100% ovicidal (eggs usually hatch in 8-9 days [range 7-12 days]).
Prevention of Transmission
▶ Items that have been in contact with the head of a louse-infested person within 24 to 48 hours should be cleaned (lice that are not on the scalp generally survive for ≤24 hours).
▶ Clothing and bed linens should be washed in hot water (>130° F) and then dried for at least 10 minutes at the hottest setting.
▶ Items that cannot be washed can be sealed in a plastic bag for 48 hours.

PYRETHRINS — Pyrethrins are natural extracts from chrysanthemum flowers that are neurotoxic to lice. They are available over the counter (OTC), usually combined with piperonyl butoxide (*Rid*, and generics) to enhance their activity. Pyrethrins are unstable in heat and light, do not kill all unhatched eggs, and require multiple treatments because they have no residual activity. Allergic reactions occur rarely in patients with ragweed or chrysanthemum allergy. Resistance to pyrethrins is now widespread.

PERMETHRIN 1% — Permethrin 1% (*Nix*, and generics) is a synthetic compound based on the insecticidal components of natural pyrethrins. Like pyrethrins, it is available OTC and resistance is widespread. Recent clinical studies have found that the effectiveness of permethrin has declined to 25% in the US.[2] Head lice that are resistant to permethrin 1% will probably also be resistant to permethrin 5%, which is available by prescription for treatment of scabies. Adverse effects of permethrin include pruritus, erythema, and edema.

MALATHION — Organophosphate insecticides such as malathion are extensively used in agriculture. An irreversible cholinesterase inhibitor, malathion is pediculicidal and partially ovicidal; retreatment is usually not necessary. The labeling for malathion 0.5% lotion (*Ovide*, and generics) recommends applying it for 8-12 hours, but one small clinical trial found one or two 20-minute applications 98% effective in eradicating lice and viable eggs.[3] Malathion is malodorous and highly flammable; patients should be warned not to use a hair dryer or curling iron after applying it.[4] Stinging sensations and chemical burns have been reported after application. Resistance of head lice to malathion has been reported in Europe, but not in the US.[2] The US product contains terpineol, dipentene, and pine needle oil, which also have pediculicidal properties. Malathion is classified as category B (no teratogenic effects in animals) for use during pregnancy.

BENZYL ALCOHOL — Lice exposed to benzyl alcohol 5% lotion *(Ulesfia)* are thought to lose the ability to close their respiratory spiracles; the lotion vehicle then obstructs their airways and causes them to asphyxiate. Benzyl alcohol has no ovicidal activity. In clinical trials, benzyl alcohol 5% lotion eliminated all live lice in about 75% of patients examined 14 days after completing two treatments given one week apart. Resistance has not been reported. Eye irritation and contact dermatitis can occur.[5] Intravenous administration of products containing benzyl alcohol has been associated with neonatal gasping syndrome, but absorption is minimal after topical application. Benzyl alcohol is classified as category B (no adequate studies in pregnant women; no teratogenic effects in animals) for use during pregnancy.

SPINOSAD — Spinosad 0.9% suspension *(Natroba)* is a semi-synthetic fermentation product of the soil actinomycete *Saccharopolyspora spinosa* that causes neuronal excitation in insects, leading to paralysis and death. It appears to be ovicidal; retreatment is usually not necessary. Spinosad suspension also contains 10% benzyl alcohol, twice the amount in *Ulesfia*. Among patients who received

Table 2. Some Drugs for Head Lice

Drug	Resistance	FDA-Approved Lower Age or Weight Limit	Dosage and Administration	Cost[1]/Size
Ivermectin 0.5% lotion – *Sklice* (Arbor)	No	6 months	Apply to dry hair and scalp for 10 min, then rinse[2]	$297.60/4 oz
Ivermectin tablets[3] – *Stromectol* (MSD)	No	15 kg[4]	200-400 mcg/kg PO once; repeat 7-10 days later	9.30[5]
Spinosad 0.9% suspension – *Natroba* (ParaPro)	No	6 months	Apply to dry hair for 10 min, then rinse; repeat 7 days later if necessary[6]	246.10/4 oz
Benzyl alcohol 5% lotion – *Ulesfia* (Lachlan)	No	6 months	Apply to dry hair for 10 min, then rinse; repeat 7 days later[7]	181.30/8 oz
Pyrethrins w/piperonyl butoxide shampoo[8] – generic *Rid* (Bayer)	Yes	2 years	Apply to dry hair for 10 min, then shampoo; repeat 7-10 days later	15.00/8 oz[9] 20.00/8 oz[9]
Permethrin 1% creme rinse[8] – generic *Nix* (Insight)	Yes	2 months	Apply to shampooed, towel-dried hair for 10 min, then rinse; repeat 7 days later	18.00/4 oz[9] 21.00/4 oz[9]
Malathion 0.5% lotion – generic *Ovide* (Taro)	Not in US	6 years[10]	Apply to dry hair for 8-12 hrs, then shampoo; repeat 7-9 days later if necessary[11,12]	221.70/2 oz 246.40/2 oz

1. Approximate WAC for the indicated size. WAC = wholesaler acquisition cost or manufacturer's published price to wholesalers; WAC represents a published catalogue or list price and may not represent an actual transactional price. Source: AnalySource® Monthly. November 5, 2016. Reprinted with permission by First Databank, Inc. All rights reserved. ©2016. www.fdbhealth.com/policies/drug-pricing-policy. Total cost of treatment may vary based on hair length and number of applications required to completely eradicate lice.
2. The manufacturer recommends using up to one single-use, 4-oz tube of topical ivermectin lotion per application.
3. Not FDA-approved for treatment of head lice.
4. The safety and effectiveness of oral ivermectin have not been established in children weighing <15 kg.
5. Cost of two 3-mg tablets (one dose for a 30-kg child at the lowest dosage).
6. The manufacturer recommends using up to one 4-oz (120 mL) bottle of spinosad 0.9% suspension per application.
7. The amount of benzyl alcohol 5% lotion recommended per application depends on hair length: 0-2 inches (4-6 oz), 2-4 inches (6-8 oz), 4-8 inches (8-12 oz), 8-16 inches (12-24 oz), 16-22 inches (24-32 oz), >22 inches (32-48 oz).
8. Available without a prescription.
9. Approximate cost according to walgreens.com. Accessed November 10, 2016.
10. The safety and effectiveness of malathion lotion have not been established in children <6 years old; it is contraindicated in children <24 months old.
11. In clinical trials, patients used a maximum of 2 fl oz of malathion lotion per application.
12. One or two 20-minute applications have also been effective (TL Meinking et al. Pediatr Dermatol 2004; 21:670).

1 or 2 treatments with spinosad, 85-87% were free of lice 14 days after the last treatment.[6] Resistance has not been reported. Erythema and irritation of the scalp, and rarely the eye, can occur.[7] Spinosad is classified as category B (no adequate studies in pregnant women; no teratogenic effects in animals) for use during pregnancy.

IVERMECTIN — Ivermectin is a fermentation product of *Streptomyces avermitilis,* a soil-dwelling actinomycete. It binds to glutamate-gated chloride channels in parasites such as lice, inducing paralysis and death.

Ivermectin 0.5% lotion *(Sklice)* is not directly ovicidal (hatchability does not decrease), but lice that hatch from treated eggs die within 48 hours after hatching, so retreatment is usually not necessary. The combined results of two double-blind, vehicle-controlled clinical trials showed that 74% of patients were lice-free on day 15 after a single treatment with ivermectin 0.5% lotion compared to 18% of those treated with the vehicle alone.[8] Resistance has not been reported. Adverse reactions to ivermectin lotion, reported in <1% of patients, have included conjunctivitis, ocular hyperemia, eye irritation, dry skin, and a burning sensation.[9] It is classified as category C (no adequate studies in pregnant women; maternal and fetal toxicity in animals with high oral doses) for use during pregnancy.

Oral ivermectin *(Stromectol)* is FDA-approved only for treatment of onchocerciasis and strongyloidosis, but it has been reported to be about 95% effective for treatment of head lice.[10,11] Two unpublished studies comparing 200- and 400-mcg/kg doses of oral ivermectin given as 1-, 2-, or 3-dose treatment regimens found that effectiveness increased with higher dosages; at day 15, a 3-day treatment (days 1, 4, 8) with 200 mcg/kg was about 80-98% effective in eradicating lice and a 2-day (days 1, 8) or 3-day (days 1, 4, 8) treatment with 400 mcg/kg was about 95-100% effective. The drug was well tolerated; 2 patients reported mild diarrhea.[12]

LINDANE — Lindane has low efficacy and is neurotoxic; it is not recommended for treatment of head lice.

AN INVESTIGATIONAL DRUG — Abametapir inhibits metalloproteinase enzymes needed for both egg development and survival of hatched lice. In two unpublished, randomized, double-blind, vehicle-

controlled trials (only available as an abstract), a single treatment with abametapir lotion 0.74% *(Xeglyze)* was 81-88% effective in eradicating lice.[13] In a study of ovicidal efficacy, 100% of abametapir-treated eggs failed to hatch.[14]

ALTERNATIVES – Manual removal of lice and nits is an alternative to pesticides, but should not be used as sole therapy except in very young children for whom pediculicidal drugs are contraindicated. Several comb products (*Lice Comb, Lockomb, Licemeister*, and others) have been approved by the FDA as alternatives to chemicals or as adjunctive treatment. For nit removal, particular attention should be paid to those located within 1 cm of the scalp; nits are not likely to hatch at temperatures lower than those near the scalp.

Occlusive products such as petroleum jelly, mayonnaise and olive oil, and some **essential oils** have been used in place of traditional pediculicides, but their effectiveness has not been established in controlled trials.[15]

High concentrations of topical **dimethicone**, a silicone compound, are thought to smother lice by blocking their ability to excrete the water taken up when feeding on blood. Three randomized trials in Europe, where dimethicone is widely used for treatment of head lice, found that products containing concentrations of 4-92% were 70-97% effective in eradicating lice by 9-14 days after treatment.[15] A liquid gel formulation containing 100% dimethicone *(LiceMD Pesticide Free)* is available OTC in the US. In a small open-label US study, 96.5% of patients were free of live lice and 80.7% were free of viable eggs 14 days after 1-3 treatments with 100% dimethicone gel (plus combing to remove lice and nits).[16] Dimethicone is not absorbed through the skin.

Isopropyl myristate 50% *(Resultz)*, a topical solution that is available in Canada for treatment of head lice in persons ≥4 years old, causes dehydration and death of head lice by dissolving the wax covering on their exoskeleton. It has been reported to be 54-82% effective in eradicating head lice in randomized clinical trials.[15,17] ■

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