

Detection and recommended treatment of head lice

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Head lice infestations are very common in school-age children and can be difficult to eradicate. This article discusses how to detect head lice, and considers the treatments options available and their efficacy, including physical removal of lice (wet combing), physical insecticides and chemical insecticides.

Head lice are wingless insects that feed on blood from the human scalp. The adult louse is approximately 3mm long (the size of a sesame seed), and is pale brown to grey-white in colour. Its legs are adapted to cling onto the scalp hairs. Lice in the UK are adapted for hairs with a round cross section, as found in Asian and Caucasian races. People of African descent have hair with an oval cross section, and are not often affected by head lice in the UK.¹

The adult female lays tiny eggs, which she cements to the hair shaft within 4mm of the scalp. The eggs are pigmented to match the hair colour of the host, which can make them difficult to spot in the scalp. The egg capsules are called nits, and may contain live eggs or be empty. (Some texts use “nits” to mean just the empty egg cases, but in general parlance the term is used to mean the egg cases, whether full or empty). They are easiest to find near the scalp margins, particularly behind the ears and at the back of the neck (see Figure 1).

The eggs take 7–12 days to hatch into nymphs, which reach sexual maturity and can start to lay eggs at seven to 13 days old. The female lice live for four to six weeks, during which time each one may lay more than 100 eggs. The empty egg cases remain attached to the hair as it grows, and so gradually move further from the scalp. The adult lice feed on blood from the scalp, and the saliva they inject while doing so causes sensitisation and itch in the host. This is an allergic phenomenon and may take several weeks to develop on the first exposure. Subsequent infestations will become itchy much more quickly due to prior sensitisation.

Detection of head lice

The presenting symptom is usually an itchy scalp. The first time someone is infested, the itch may take some weeks to develop; with subsequent infestations the onset of itch is sooner. It is not uncommon for a child who has not had lice before to

present with occipital lymphadenopathy without itch, secondary impetigo at the back of the neck, or indeed to be asymptomatic. Scratching can cause excoriations, which can become secondarily infected. If head lice are suspected, the key features to look for are:

- Eggs cases close to the scalp, which contain live eggs. These may be difficult to see with the naked eye, and a magnifying glass or dermatoscope may be useful.
- Egg cases further away from the scalp may be easier to spot. They are transparent and show up more easily on dark hair. If the person has been treated recently then these egg cases may not indicate an active infestation.
- Live lice on the scalp. If any are seen, this is a definite indicator of current infestation. Combing with a detection comb may catch a few live lice. Note that the detection comb has wider spaced teeth than the combs designed for nit removal, and is more effective if used on wet hair.²
- Lice droppings, which look like tiny dark specks, may be found on pillows or clothing.

Differential diagnosis

The commonest condition to be mistaken for head lice infestation is dandruff. This may be due to dry skin on the scalp, or skin conditions such as seborrhoeic dermatitis or atopic eczema. Occasionally hair care products can also look like nits. However, dandruff and hair care products can be easily removed from the hair shaft with fingers, whereas nits are very firmly attached.

Transmission of lice

A commonly asked question is who in the family should be treated if one member is identified as having head lice. Transmission usually occurs by direct head-to-head contact, and it is rare for lice to be transmitted on hairbrushes or by static electric transfer. All family members and any contacts who may have had head-to-head contact should be inspected for signs of infestation.

If a school-age child is infested, they do not need to be excluded from school while being treated. It is sensible to inform the school, so they can inform all the parents to check for lice, without identifying the index case.

Head lice treatments

It is recommended that all infested household contacts are treated on the same day in order to reduce reinfestation rates. The whole household should be checked, but it is only necessary to treat if live lice are found on the scalp. After any treatment has been completed, the scalp should be checked again for lice one to two weeks later to ensure that treatment has not failed. It is common for the itchy scalp to persist for several days after even a successful treatment, so itch alone cannot be used as an indicator of treatment failure.³

The treatment options fall into three categories: physical removal of lice, physical insecticides (see Table 1) and chemical insecticides.⁴



Figure 1. Nits are easiest to find near the scalp margins, particularly behind the ears and at the back of the neck

In previous years, chemical insecticides were the most effective treatments, and many older studies demonstrated their effectiveness compared with physical removal techniques. However, resistance to chemical insecticides was reported in the UK from the late 1990s,⁵ and remains a problem. This is why the physical methods are now the preferred options.

Physical removal of lice and nits

The lice and nits can be removed by wet combing (see Figure 2). The hair should be washed as normal, and conditioner applied. Before rinsing off the conditioner, the hair should be divided into small sections and each area combed through thoroughly, starting close to the scalp, right to the ends of the hair. The whole scalp should be combed through twice at each sitting. Any lice or nits collected on the comb should be removed onto a tissue or cloth after each pull of the comb.

Various types of comb are available, and several can be prescribed on FP10, eg Nitty Gritty NitFree comb, Nitcomb-S1, Nitcomb-M2 and Portia head lice comb. The plastic Bug Buster comb is the one with the most published evidence base to support its use, but there is no reason to believe any of the metal combs to be less effective. A study of a plastic comb against a metal comb in Australia found the metal comb to be more effective.⁶ The Bug Buster comb is prescribable as a kit

containing three bug buster combs, one nit buster comb, one wide-tooth comb and a protective cape.

The combing needs to be repeated at intervals, as combs are better at removing adult lice than eggs. If performed every fourth day (in practical terms, twice a week is easier to remember), then no recently hatched nymphs will have reached maturity to lay new eggs. Given that the eggs may take up to 12 days

to hatch, it is important to perform the wet combing until three consecutive combing episodes have yielded no lice.

Wet combing with conditioner was the most popular method of head lice removal with parents in a survey by the consumer association *Which?*⁷ but they also point out that the nit combs are not effective for people with Afro-Caribbean hair. However, people with Afro-Caribbean hair have a much lower

Physical insecticide	Products	Application	Children	Used in pregnancy and breast feeding?	Other comments
Dimeticone 4% lotion	Hedrin lotion, chemists' own head lice spray	Apply to dry hair, dry naturally, wash out after 8 hours, repeat 5–7 days later	Medical advice for children aged under 6 months	Yes	Avoid contact with naked flame. May be difficult to wash out. (Hedrin lotion is not on <i>Drug Tariff</i> , but chemists' own head lice spray is)
Dimeticone 4%/nerolidol gel	Hedrin Once gel	Apply to dry hair, leave 15 mins then wash out, single application	From age 6 months	Yes	Avoid contact with naked flame. May be difficult to wash out. Liquid gel and spray gel are on <i>Drug Tariff</i>
Dimeticone 92%	NYDA	Apply to dry hair, dry naturally, wash out after 8 hours. May need to repeat after 8–10 days	From age 2 years	Medical advice/ not recommended due to lack of safety data	On <i>Drug Tariff</i> . Avoid contact with flames
Dimeticone 95%	Linicin lotion	Apply to dry hair for 15 mins, wash out and comb through to remove dead lice. Repeat 9 days later	From age 6 months	Medical advice	On <i>Drug Tariff</i> . Avoid contact with naked flames
Isopropyl myristate/ cyclomethicone	Full Marks solution	Apply to dry hair for 10 mins, comb through, wash out and repeat 7 days later as required	From age 2 years	No information/ not recommended due to lack of safety data	On <i>Drug Tariff</i>
Octane-1,2-diol	Hedrin Treat and Go	Apply to dry hair, leave for 8 hours and wash out. Repeat at 7 days	From age 6 months	Yes	Not on <i>Drug Tariff</i>
Isopropyl myristate/ isopropyl alcohol	Vamousse	Apply mousse to dry hair for 15 mins, comb, wash out	From age 2 years	Not specified	Flammable aerosol, on <i>Drug Tariff</i>

Note: Items on the *Drug Tariff* (September 2016) may be prescribed on FP10

Table 1. Physical insecticides for treatment of head lice and how to use them

incidence of head lice in the UK. A whole-school bug busting approach can be adopted, reducing the cost to primary care of treating head lice.⁸

Physical insecticides

Dimeticone preparations are silicone oils that immobilise the lice and block the spiracles, preventing water excretion and causing physiological stress and ultimately death. Their physical mode of action means that resistance is unlikely to develop. They are not flammable, but treated hair can readily burn if ignited so care should be taken to keep away from naked flames and not to smoke when using them.

Dimeticone 4% lotion (Hedrin lotion, not prescribable on FP10 but can be purchased over the counter) is licensed for use in people of all ages, including those with asthma or skin conditions. It does not contain alcohol, so usually does not irritate the sensitive scalp, and can be used in pregnancy and breast feeding. It is applied to dry hair, and the product should then be left to dry on the hair naturally. It should be washed off after eight hours. It only kills live lice, so the application has to be repeated seven days later. It is very oily, and may be difficult to remove with normal shampoo – anecdotal reports of washing-up liquid being required to remove it are common, and this is clearly not advisable for people with sensitive skin or eczema. It is important to supply sufficient for two applications – a 150ml bottle will be needed if hair is longer than shoulder length or very thick, but the 50ml bottle is adequate for short hair. Hedrin Once liquid gel (containing 4% dimeticone plus nerolidol) is easier to apply than the lotion, and can be washed out after 15 minutes. It is better at killing the eggs than Hedrin lotion, in spite of the short contact time, and can thus be used as a single application.

Dimeticone 92% spray (NYDA) probably has better ovicidal activity than the dimeticone 4% preparations. It works in a similar way to the 4% concentration, but contains a mixture of two dimeticone formulations with different viscosities. It enters the aerophytes of eggs as well as the spiracles of lice. It is designed to eradicate live lice and their eggs in one application, but it is still recommended to check for lice 8–10 days later and treat again if any are found. One 50ml spray is enough for two applications on shorter hair, but a 100ml pack will be needed for those with long thick hair. It should be applied to dry hair and allowed to dry for 30 minutes before combing to remove any suffocated lice. It is left on for eight hours after this to ensure any remaining lice are killed. Like the dimeticone 4% preparations, it is oily and may be difficult to remove with shampoo. It may also react with some hair colourings. It is not recommended in children under two years, or in pregnancy or breast feeding, due to lack of safety data.

Dimeticone 95% (Linicin), which also contains almond oil, apricot kernel oil and vitamin E, coats and smothers the lice and the eggs and takes 15 minutes to work. Hair should be combed through after treatment to remove the dead lice. Treatment should be repeated after nine days.

Isopropyl myristate and cyclomethicone (Full Marks solu-



Figure 2. Physical methods of head lice removal, such as wet combing, are now the preferred options because lice have developed resistance to chemical insecticides

tion) works by dissolving the wax coating on the louse exoskeleton, causing death by dehydration. It is applied to dry hair for 10 minutes, combed through then washed out, and repeated a week later. It can be used by people with asthma, but is not recommended in people with pre-existing inflammatory skin conditions on the scalp, children under two years, or in pregnancy or breast feeding, due to lack of safety data.

Octane-1,2-diol (Hedrin Treat and Go spray, mousse or lotion) is a novel surfactant that disrupts the lice cuticle and causes death by dehydration. It is applied to dry hair and washed out after eight hours. Treatment must be repeated after seven days.

Vamousse is a newer product to the market, which contains isopropyl myristate and isopropyl alcohol to dissolve the protective exoskeleton of lice. The mousse is applied to dry hair to wet it, left for 15 mins, then combed through with the metal comb provided in the packet until all lice and nits have been physically removed before washing it out. The alcohol content makes it flammable so it should be kept away from flames. It is for single treatment. I was unable to find any published evidence of its effectiveness.

<p>Step 1: Identify who to treat: confirm presence of live lice and check close contacts and family members for presence of live lice</p>
<p>Step 2: Offer a choice of a physical insecticide or a nit removal comb to be used with patient's normal conditioner</p>
<p>Step 3: If treatment fails with a physical insecticide or nit removal comb, check it has been used properly and that all contacts have been treated at the same time. Advise that reinfestation is common, particularly in schools, and they may need to retreat regularly while head lice are circulating at school</p>
<p>Step 4: If recurrent reinfestation occurs, suggest regular wet combing to remove lice, and consider communication with school to ask them to remind all families to check for lice. Physical insecticides may need to be used repeatedly for maximum effectiveness</p>
<p>Note: Offer a chemical insecticide only in exceptional circumstances, to people over six months of age, where physical insecticides have genuinely failed and you are sure it is not a case of incomplete treatment or reinfestation. Warn patients that physical insecticides are more effective than chemical ones</p>

Figure 3. Recommended treatment of head lice

Chemical insecticides

There are two licensed chemical insecticides for head lice in the UK: permethrin and malathion. Permethrin is a neurotoxin to the lice, with very little toxicity to mammals. Although it has been claimed to remain on hair for two weeks after application, this is reduced by silicone-based additives as found in many shampoos and conditioners. It is not as toxic to the eggs as to the lice, and two treatments a week apart is the recommended regimen. Resistance rates to permethrin in the UK are high, with a success rate as low as 13% in one study⁹ and significantly less than with 4% dimeticone preparations or isopropyl myristate/cyclomethicone solution.² The only permethrin product licensed for head lice (Lyclear Creme Rinse) is not recommended due to its short contact time of 10 minutes.¹⁰

Malathion, an organophosphate insecticide, remains an option, and is considered safe in pregnancy and breast feeding. It has a distinctive smell, and can cause skin irritation even in aqueous solution. Resistance has been reported at high levels in the UK,¹¹ skin irritation and hypersensitivity reaction have been reported,² and it is less effective than 4% dimeticone lotion in head-to-head trials,¹² so is not generally recommended as a first-line treatment.

Other products

Many other products are marketed for treatment of head lice. These include essential oil-based remedies (containing tea

tree, eucalyptus and lavender oils), Nitlotion (containing coconut oil), Lice Attack shampoo, Dove hair conditioner and homeopathic remedies. These are not recommended due to a lack of consistent evidence of their safety and efficacy.² Electric combs are also not recommended because they are expensive and may pose a safety risk if used incorrectly.²

Many home remedies are also popular, including mayonnaise (either used instead of conditioner, or left on overnight), garlic paste, diluted white wine vinegar, baby oil and petroleum jelly. None of these are likely to be harmful (although some will inevitably be smelly), but there is a lack of evidence for their effectiveness. Tea tree oil has been shown to be toxic to lice *in vitro*,¹³ but details of how to dilute for use *in vivo* are scarce and conflicting, and tea tree oil is known to cause skin irritation in some individuals.

References

1. Pray WS. Head lice: perfectly adapted human predators. Available online at: <http://www.headlice.org/news/1999/prayarticle.html> [accessed 25 August 2016].
2. Clinical Knowledge Summaries. Head lice. Available at: <https://cks.nice.org.uk/head-lice> [accessed 25 August 2016].
3. Devore CD, et al. Head lice. *Paediatrics* 2015;135(5):e1355–65.
4. Burgess IF. The mode of action of dimeticone 4% lotion against head lice, *Pediculus capitis*. *BMC Pharmacol* 2009;9:3.
5. Downs AM, et al. Evidence for double resistance to permethrin and malathion in head lice. *Br J Dermatol* 1999;141(3):508–11.
6. Speare R, et al. Comparative efficacy of two nit combs in removing head lice (*Pediculus humanus var. capitis*) and their eggs. *Int J Dermatol* 2007;46(12):1275–8.
7. Which? The best nit and head lice treatments. Available online at: www.which.co.uk/reviews/head-lice-and-nits/article/treating-head-lice-and-nits/the-best-head-lice-treatments [accessed 25 August 2016].
8. Ibarra J, et al. Overcoming health inequalities by using the Bug Busting 'whole-school approach' to eradicate head lice. *J Clin Nursing* 2007;16(10):1955–65.
9. Downs AM, et al. Evidence for double resistance to permethrin and malathion in head lice. *Br J Dermatol* 1999;141:508–11.
10. *BNF* 72. September 2016–March 2017. BMJ Group and Pharmaceutical Press, 2016.
11. Durand R, et al. Insecticide resistance in head lice: clinical, parasitological and genetic aspects. *Clin Microbiol Infect* 2012;18 (4):338–44.
12. Burgess IF, et al. Randomised, controlled, assessor blind trial comparing 4% dimeticone lotion with 0.5% malathion liquid for head louse infestation. *PLoS One* 2007;2(11):e1127.
13. Di Campli E, et al. Activity of tea tree oil and nerolidol alone or in combination against *Pediculus capitis* (head lice) and its eggs. *Parasitol Res* 2012;111(5):1985–92.

Declaration of interests

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