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COMMENTARY

Getting ahead of head lice

David de Berker[1] and Rodney Sinclair[2]

[1]*Bristol Dermatology Centre, Bristol Royal Infirmary, Bristol, United Kingdom,*
[2]*Department of Dermatology, St. Vincent's Hospital, Fitzroy, Victoria, Australia*

SUMMARY

Dermatologists are the nominal experts in the management of head lice in Australia, yet many dermatologists infrequently treat patients with this condition. Most people are managed in the community by school nurses, local council health officers, pharmacists, paediatricians or general practitioners. Only a small number will present to the dermatologist and commonly these patients will have tried a variety of treatments and failed to respond. Resistance is reported to all of the currently available insecticide treatments and this makes management of this common community-acquired infestation more involved.

Key words: cotrimoxazole, DDT, ivermectin, lindane, malathion, pediculosis capitis, permethrin, piperonyl butoxide, public health, pyrethrins, resistance, treatment.

The article in this issue by Bailey and Prociv[1] on head lice will strike a familiar note with parents and doctors alike. Their account is similar to that given by another medical family dogged by recurrent infestations.[2]

The natural history of infestation has been described in a volunteer to continuous exposure to lice bites.[3] The sequence of skin reactions were: phase 1, no clinical symptoms; phase 2, pruritic papules; phase 3, immediate wheal formation after bites, followed by an intensely itchy delayed papular eruption; phase 4, papular reaction with diminished skin reactivity and mild pruritus. Healed bite reactions reappeared when other parts of the skin were again exposed to lice.

Head lice are seldom cited as a health risk, but rather a source of domestic frustration and upheaval in the school, home and doctor's office. The difficulties in treatment fall into three categories: biological resistance to a range of chemical insecticides; practical and social problems with the application of physical therapies; and re-infestation. It is notable that Bailey and Prociv felt the last aspect was not contributory to their protracted problem.

Correspondence: Rodney Sinclair, Department of Dermatology, St Vincent's Hospital, Fitzroy, Vic. 3065, Australia.
Email: sinclair@svhm.org.au
Rodney Sinclair, FACD. David de Berker, MRCP.

BIOLOGICAL RESISTANCE

Reports of resistance began to emerge from all over the world[4–12] soon after the introduction of insecticides for the treatment of head lice. In the 1980s, dichlorodiphenyl trichloroethane (DDT)[4] was the first agent suspected, followed by lindane[5,6,12] and latterly malathion,[6–12] permethrin[6,12] and pyrethrins with piperonyl butoxide[8] (Table 1). Some lice now appear to be multiply resistant, with levels of *in vivo* resistance to permethrin rising to 87% in an urban setting such as Bristol, England, with coincident resistance to malathion of 64%.[12] These figures represent children undergoing supervised applications by medical staff. Head lice harvested from the same group of children were tested *in vitro* to representative concentrations of both insecticides and to DDT and carbaryl. The patterns of resistance mimicked the clinical resistance in the first three, with only carbaryl allowing survival of less than 5% of tested lice. Permethrin, pyrethrins with piperonyl butoxide and malathion are available over the counter in the United Kingdom (UK), as in many other parts of the world, and these patterns of resistance are probably widespread.

Cotrimoxazole has been reported as an effective treatment for head lice.[13] The putative mechanism of action is on symbiotic Gram-negative bacteria in the gut of the louse that are required for digestion of ingested blood products. Unfortunately, it is only effective against adult and nymphal stages but not the eggs, so prolonged courses are required.[14]

Newer agents such as ivermectin[15] may hold promise, but there are reports of fatal toxicity in veterinary use and a fear of increased susceptibility to neurological side-effects in children.[16] A 1% shampoo formulation warrants further investigation.[17]

However, the adaptability of head lice is well proven and it is likely that resistance will also develop in time to these new agents. It is this setting that makes physical treatments an attractive option.

PHYSICAL THERAPIES AND THEIR APPLICATION

Physical therapies are legion and are poorly studied. They utilize a range of approaches; the most popular is extraction of eggs and lice with a fine comb. Metal combs are better than plastic and it is useful to have a lubricant (such as conditioner) to assist clearing knots and to make the process more comfortable. Combing regimens are not specific but are designed to remove mature lice which might otherwise lay eggs and perpetuate the life cycle. If no adult lice have been found for 2 weeks, it is likely that the cycle has been broken. Combing can be undertaken every one to 3 days.

Although there are reputable claims that this method is effective[18] there are no good randomized or controlled trials. As Bailey and Prociv point out, it is difficult to comb effectively and to be sure that all the lice on the scalp are found when the hair is long and thick, and residual lice could easily result in treatment failure.[1] Eighty percent of infestations represent a load of only 1–10 lice, which means that it is easy to miss the diagnosis or a residual louse.[19]

Alternatives include killing the adults with an electric comb that discharges a small shock, shaving the hair, or using agents such as petrolatum, olive oil or even mayonnaise that suffocate the lice. To suffocate the lice, a generous quantity of grease is massaged into the scalp and over the hair. It is then washed out over successive nights with shampoo. This is time consuming, particularly when the hair is long or thick. Petrolatum is, of course, not to be confused with petrol or kerosene; both have been advocated, but are dangerously flammable, a problem shared with alcohol-based topical products that also have the potential for exacerbating asthma.

From the account of Bailey and Prociv,[1] it seems that a combination of shorter hair and diligent combing was eventually successful. From the domestic angle, it is difficult to get young children to be still for 20 min each, while the wet or lubricated hair is combed with a fine nit comb, a procedure that may have to be repeated for weeks on end.

In principal, shaving, petrolatum or combing might be 100% effective. However, on a population basis, the results are less encouraging. Twelve months after an educational programme to describe 'nit busting' in local primary schools, the prevalence of infestation in those schools had risen.[20] This could represent a failure of the educational process, poor motivation within the family, or some other biological or social process resulting in increased infestation. Limited trials on a modest scale suggest that combing might work, but it may still be difficult to achieve success across the board.

Table 1 Reports of insecticide resistance in the treatment of head lice

Agent	Year	Country	Ref.
DDT	1982	Malaysia	4
Lindane	1983	USA	5
Lindane, pyrethroids, malathion*	1990	Australia	6
Permethrin	1995	Czech Republic	7
Pyrethroids	1995	Britain	8
Permethrin	1995	Israel	9
Permethrin, sumithrin, deltamethrin	1998	Argentina	10
Permethrin	1999	USA	11
Malathion and permethrin	1999	Britain	12

DDT, Dichlorodiphenyl trichloroethane; Ref., reference number. *All separate cases.

RE-INFESTATION AND SCHOOL EXCLUSION

One modality that combines physical treatment and motivation is school exclusion. This is common in schools in Australia and the United States of America. For the strategy to be successful, all children in the class must be evaluated by health professionals after the reporting of a single case. All those affected must be excluded. Exclusion could be overnight during treatment[21] or for 2 weeks, depending on whether the aim is to ensure therapy or cure. Theoretically, re-admission is only after clearance has been confirmed by examination.

There is no recent evidence that exclusion is effective in controlling head lice in school children. Possibly this is because it is difficult and expensive to fully enforce. Failure is likely in areas of pharmacological resistance, where re-infestation occurs within the family or where motivation is lacking and family order less defined. Some children could continue to be excluded for prolonged periods, based on social factors that reduce the chances of effective treatment. These kinds of consideration must bring exclusion into question and it has been challenged by some authorities.[21]

ECONOMIC CONSIDERATIONS

So what is the cost? There are the costs of chemicals, family time, and potential social and educational costs. The pharmaceutical industry is likely to continue to produce new chemicals that will gradually increase in cost and provide only temporary benefit. Prescriptions for pediculocides in England rose 500% between 1985 and 1995, reflecting a combination of resistance and increased prevalence.[22] Families are variable in their ability to apply treatments, with a mixture of poor information and confusion complicating the situation. Sources of clear information may not always be to hand for clinician or patient (Table 2). The emerging patterns of resistance

Table 2 Sources of information on the Internet, including patient information leaflets

- http://www.hsph.harvard.edu/headlice.html
  Well balanced, comprehensive website useful to clinicians and patients
- http://www.headlice.org
  Designed by an interest group with a heavy emphasis on eradication. Contains an aggressive protocol for combing and some up-to-date background publications
- http://medinfo.co.uk/conditions/headlice.html
  Background information and a good description of combing
- http://www.dhs.vic.gov.au
  'Head lice' search at this site yields several pages, including professional notes and a multilingual patient information sheet. No mention of combing or insecticide resistance

Table 3 International surveys of head lice infestation in school children

Country	Date	Primary school students infested (%)	Ref.
Australia	1999	33.7	26
England	1999	18.7	27
Malaysia	1980	10.7	4
Korea	1995	9.4 girls; 0.5 boys	28
Nigeria	1985	13.5	29

Ref., Reference number.

mean that last year's literature may be misleading. Although a systematic review[23] concluded permethrin was the only drug to be supported on the basis of the evidence, it is also the drug for which there is most evidence of resistance. In this particular review, other drugs, such as carbaryl, were excluded because of lack of studies, not evidence of lack of efficacy.[23]

Can head lice spread serious diseases? Impetigo may be a complication. Where typhus is prevalent, as in some African countries, body lice may contain *Rickettsia prowazekii*.[24] Although mentioned in a recent review,[25] there is no modern English language literature concerning head lice as a vector for typhus or trench fever. To a great extent, the problem, if it is a problem, is seen as one affecting the school and educational process. Data from schools in different parts of the world[26–29] illustrate that infestation is common (Table 3). Within Australian schools, infestation rates of 72% and zero have been reported in separate classrooms of the same school.[26] Perhaps the classroom is where the problem should be tackled. If the efficacy of combing could be established, in endemic areas this cheap and non-toxic treatment could be made part of the weekly curriculum!

Until this becomes the case, an approach to treatment could be an initial treatment with a pediculocide alone or together with daily combing, depending on preference.[30] The pediculocide could be permethrin or malathion or pyrethrins with piperonyl butoxide, depending on local experience. If there is treatment failure, a different pediculocide should be used, with carbaryl representing the agent with least reported resistance. Alternatively, combing alone could be encouraged where the situation suggests that it will be done diligently. In all cases, combing should be used as part of scalp assessment and continued surveillance of the affected child and other family members. In resistant cases, cotrimoxazole or ivermectin can be used. Patients can be referred to websites with reasonable advice, or material can be downloaded for dissemination by the health professional (Table 2). This includes detailed advice on combing and treatment of potential fomites. The latter are not a major problem and a hot wash of bedding linen and clothes should normally suffice.

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