Clinical review

More common skin infections in children

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The first part of this review of common childhood skin infections appeared last July (*BMJ* 2004;329:95-9). Here the authors review four more conditions.

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Childhood skin infections are commonly seen in both primary care and dermatology practice worldwide. They consume considerable resources and need careful management. However, education and reassurance of patients and parents, combined with simple treatment and self management, play a vital part in successful treatment. We recently reviewed four common childhood skin infections: molluscum contagiosum, cutaneous viral warts, impetigo, and tinea capitis.¹ We now review four more skin infections commonly seen in children, describing the epidemiology, clinical features, and treatment of each. For conditions with limited evidence, we provide pragmatic advice and recommendations.

Sources and selection criteria

We searched Medline, Embase, and the Cochrane Library by using the terms “scabies,” “head lice,” “folliculitis,” and “herpes simplex virus.” We included randomised trials, reviews, meta-analyses, and guidelines.

Scabies

Scabies is an intensely itchy dermatosis caused by the mite *Sarcoptes scabiei*. The infestation can occur at all ages but particularly occurs in children. It is a common public health problem in poor communities and developing countries.

Scabies is highly contagious and is spread from person to person by direct skin contact. Transfer from clothes and bedding occurs rarely and only if contaminated by infectious people immediately beforehand.² Infestation occurs when pregnant female mites burrow into the skin and lay eggs. After two or three days the larvae emerge and dig new burrows. They mature, mate, and repeat this cycle every two weeks.

The main symptoms of scabies are caused by the host immune reaction to burrowed mites and their products.³ Symptoms appear within two to six weeks of the initial infestation, but reinfestation can provoke symptoms within 48 hours. The most common presenting lesions are papules, vesicles, pustules, and nodules. The pathognomonic sign is the burrow—a short, wavy, grey line that is often missed if the skin is eczematized, excoriated, or impetiginized. In adults, scabies is characterised by intractable pruritus, which is worse at night, and lesions in the web spaces, fingers, flexor surfaces of the wrists, axillae, and genital areas.

In infants and young children, scabies often affects the face, head, neck, scalp, palms, and soles (fig 1).

Summary points

A high index of suspicion is needed to diagnose scabies correctly

Permethrin 5% dermal cream is the treatment of choice for scabies in the UK, Australia, and USA; however, incorrect or inappropriate treatment is ineffective and promotes drug resistance

The diagnosis of active head lice infestation, as shown by the existence of live lice, is essential before starting treatment

Pediculosis capitis should be treated with aqueous lotions or liquid formulations, two applications seven days apart; we use permethrin 5% dermal cream (off-licence indication) or malathion

Folliculitis is common, is usually caused by *Staphylococcus aureus*, and is effectively treated by topical antiseptics and topical antibiotics

In severe or refractory folliculitis, nasal swabs from the patient and immediate relatives should be taken to identify asymptomatic carriers of *S aureus*

Herpes simplex virus can result in eczema herpeticum in patients with pre-existing (often mild) atopic eczema

Widespread eczematized erythema is common, particularly on the trunk, and is sometimes more troublesome than are lesions at typical sites. Very young babies do not scratch and may just seem miserable or feed poorly. Pinkish brown scabetic nodules are common in babies and can resemble mastocytomas or other infiltrative conditions.

A high index of suspicion is needed to make the correct diagnosis of scabies because of the wide range of symptoms and presentations. For example, the distribution of lesions in adults (rarely on the face and neck) and children (commonly on the face and neck) is different. A history of itching in several family members over the same period is virtually pathognomonic of scabies. Lack of a history of itching in family members does not exclude scabies, however, because family members may not admit to a history of possible

scabies, and some people with scabies genuinely do not itch. Untreated, scabies can continue for many months. Recurrence of symptoms after treatment does not exclude scabies.

The definitive diagnosis of scabies relies on microscopic identification of mites, eggs, or faecal pellets from burrow scrapings. Treatment should be given if scabies is suspected, even without microscopic evidence.⁴ A variety of effective topical medications are available to treat scabies, including permethrin, malathion, benzyl benzoate, lindane, and crotamiton. Treatment selection is determined by factors such as the age of the child (see www.bnf.org),⁵ local experience of and resistance patterns to scabesticides, drug toxicity, and (particularly in underdeveloped countries) cost and availability. Children should be given aqueous preparations, as alcoholic lotions sting and can make them wheeze. Topical preparations must be applied correctly to maximise the success of treatment (box).

Permethrin 5% dermal cream is the treatment of choice for scabies in the United Kingdom, Australia, and the United States.³ It is the most effective topical agent,² is well tolerated, and has low toxicity (www.bnf.org). It should be applied on two occasions, one week apart. For children under 2 years, medical supervision is needed.

Malathion is the second choice for treatment. Medical supervision is needed for children under 6 months. Malathion is cheaper than permethrin and, for adult contacts, cheaper than a prescription.

Lindane is less effective than permethrin and has been withdrawn in many countries because of reports of aplastic anaemia and concerns about potential neurotoxicity. Benzyl benzoate is irritant and not recommended for children.

The oral antiparasitic drug ivermectin is an effective scabicide.² Two doses of ivermectin (200 µg/kg body weight, two weeks apart) seem to be as effective as a single application of permethrin.⁶ However, the drug has not been evaluated in children weighing less than 15 kg, and its role in treating scabies remains unclear.⁷

Fig 1 Typical childhood scabies, showing multiple pruritic papules, vesicles, and pustules. The pathognomonic scabetic burrows are arrowed

Important considerations when treating children with scabies

Aspects of treatment

- Treatment should be applied to the whole body (except head and neck), including the web spaces of fingers and toes, the genitalia, and under the nails
- In children aged up to 2 years, the application should be extended to the scalp, neck, face, and ears
- All members of the affected household should be treated at the same time (as should the sexual contacts of adults)
- The application should be washed off after the recommended time (12 hours for permethrin) and clothes and bed linen machine washed at temperatures above 50°C⁴
- Permethrin and malathion should be applied twice, one week apart
- Treatment must be reapplied to the hands if they are washed
- The itch and eczema of scabies may continue for some weeks after successful treatment; moisturisers, crotamiton, and moderate strength topical corticosteroids reduce these symptoms. However, persistent symptoms suggest that scabies eradication was unsuccessful (www.bnf.org)

Common reasons for treatment failure

- Children suck the treatment off their fingers
- People wash the lotion off their hands (and do not reapply it)
- Pregnant women, people with other skin diseases, and babies often escape treatment
- Children sometimes live in more than one household
- The treatment may not have been applied on two occasions, seven days apart

Head lice (pediculosis capitis)

Pediculosis capitis is a scalp infestation by the human head louse (*Pediculus humanus capitis*) (fig 2). Head lice infestation is common throughout the world, crossing all economic and social boundaries.⁸ It is most common in children aged 4-11 years, but occurs in people of all ages.⁹ In Western societies, parents are often embarrassed if children have head lice, because of the misconception that lice are associated with poor hygiene. In other societies, the infestation is considered normal. The worldwide cost of treatment is high.¹⁰

The head louse is a grey-brown, six legged wingless insect, 1-3 mm long, which feeds by sucking blood from the host's scalp. Once infestation occurs, the female louse mates and lays eggs within two days of becoming an adult. The eggs (nits) are deposited on a hair, attached close to the scalp by a glue-like glandular secretion. They hatch in seven days, and the eggshells are left empty. Young lice (nymphs) take 10-14 days to become adults, when they too begin laying eggs. The infestation spreads from person to person only by relatively prolonged head to head contact, usually occurring between people who know each other well.¹¹ Head lice found on hats, pillows, and other locations are usually dead or sick and unlikely to transmit the infestation.⁹ Most people are initially asymptomatic and unaware of the infestation,¹² because pruritus, an allergic reaction to louse saliva, takes up to three months to develop.¹³ Head lice infestation is a common

Fig 2 Pediculosis capitis, showing live lice and nits

cause of scalp impetigo in developed countries,¹⁴ but is not a vector for other diseases.

A diagnosis of active infestation is confirmed by the existence of live lice.¹⁵ The presence of eggs alone (without live lice) may reflect previous or treated infestation. Treatment should not be applied unless live lice are discovered,¹⁶ in order to minimise the development of drug resistance. Automatic treatment of family members is not necessary, but contacts should have detection combing for live lice and be treated if positive.⁵

There is good evidence that permethrin,^{17 18} synergised pyrethrin (natural pyrethrin combined with other agents to enhance activity),¹⁸ and malathion^{19 20} are effective at treating pediculosis capitis.⁹ However, as resistance to insecticides is increasing,²¹ treatment should be based on local experience and resistance patterns.

Head lice infestation should be treated with lotion or liquid formulations. Shampoos are diluted too much in use to be effective. We advise the use of aqueous solutions (not alcohol based preparations) to avoid skin irritation and wheeze. At least 50 ml (100 ml for thick hair) should be applied to the whole scalp and left on for 12 hours.⁵ Although one treatment application is usually adequate, a second application seven days after the first is recommended because some eggs may survive. Under-treatment in the presence of newly hatched young lice exacerbates drug resistance. To reduce the development of resistance, if a course of treatment fails to provide a cure (live lice present after second application), a different insecticide should be used for the next course.

Malathion 0.5% (aqueous) liquid is rubbed into dry hair and scalp and allowed to dry naturally. It should be washed off after 12 hours and the application repeated after seven days (www.bnf.org). It is highly effective at killing both adult lice and ova. Medical supervision is needed for children under 6 months.

Although permethrin is active against head lice,⁹ the formulations and licensed methods of application of products currently available in the United Kingdom make them unsuitable for treating head lice. Our local practice is to use permethrin 5% dermal cream massaged into the scalp overnight and washed off the next morning, repeated after one week (off licence). This seems effective and overcomes problems of insecticide dilution and short contact time.

Carbaryl 1% aqueous liquid, used similarly to malathion, is also effective at treating head lice. However, because there is a theoretical risk that it may be a human carcinogen, it is available only on prescription in the UK. For children under 6 months, medical supervision is needed.

Mechanical measures, such as “wet combing,” have been used as adjuncts to insecticides, but evidence suggests they are unhelpful.²¹ “Bug busting” involves meticulous combing of wet hair with the detection comb (half an hour each time) over the whole scalp every four days for a minimum of two weeks, with the aim of eradicating lice. Little evidence exists to show that “bug busting” is effective, however, and it should not be advocated as first line treatment in the general population.^{9 20} Electronic combs and tea tree oil have also been used to treat head lice, but evidence of effectiveness is lacking. In developing countries, where products are usually unavailable or prohibitively expensive, patients may choose cheaper or traditional treatments (for which there is little evidence) or low grade agricultural insecticides (which can be fatal).²²

Persistent head lice is a common and frustrating problem. It is important to explain to parents the difference between resistance and reinfection. Parents should liaise with the school if their children have head lice.

Folliculitis

Folliculitis is a superficial inflammation of the hair follicles. It is common and can occur at any age.²³ It is usually caused by bacteria, particularly *Staphylococcus aureus*, but can also be caused by *Pityrosporum*. Persistent bacterial folliculitis can be caused by diabetes, friction from tight jeans, occlusive dressings, and shaving.

Folliculitis begins as inflammation of the follicular ostium and can be pruritic or painful. The lesions develop into 1-5 mm yellow-grey papules or pustules, with surrounding erythema, confined to the follicular ostia (fig 3). They can be grouped or discrete and usually occur on the scalp, face, buttocks, and extremities. There are usually no systemic symptoms.

Uncomplicated folliculitis is managed by removing causative factors and cleansing with topical antiseptics. Antiseptics, including chlorhexidine, triclosan, and povidone-iodine, can be used as creams or lotions, soap substitutes, and bath additives. Emollient-antiseptic combinations, such as Dermol (Dermal Laboratories)

Fig 3 Grouped yellow-grey papules and pustules of folliculitis, with surrounding erythema

Fig 4 Typical targetoid lesions of erythema multiforme

Fig 5 Classical eczema herpeticum, showing extensive vesicles and erosions

and Oilatum Plus (Stiefel Laboratories), may be particularly useful in children to reduce skin irritation.

Resistant lesions respond to topical mupirocin or fusidic acid. Resistance to fusidic acid is increasing, however, and it should be used only for short periods (2 weeks).

For severe or refractory folliculitis, we recommend that systemic antibiotics should be used empirically, as for impetigo, depending on local bacterial resistance patterns and individual tolerability.¹ Gram stain, culture, and sensitivity of lesion exudate confirm the diagnosis and guide treatment. If the infection of the follicle is deeper and involves more follicles it develops into the furuncle and carbuncle stages and usually needs incision and drainage.²³ Nasal swabs should be taken from the patient and immediate relatives to identify asymptomatic carriers of *S aureus*.²⁴ Nasal mupirocin is particularly effective at eliminating nasal carriage.

Cold sores (herpes simplex virus)

Herpes simplex virus (HSV) infection is very common and typically results in mucocutaneous disease.²⁵ It is transmitted by mucosal or skin contact from an infected person shedding virus. HSV-1 usually causes orofacial disease, and HSV-2 causes genital infection.

Additional educational resources

Review articles

Walker GJA, Johnstone PW. Interventions for treating scabies. *Cochrane Database Syst Rev* 2000;(3):CD000320

The management of scabies. *Drug Ther Bull* 2002;40:43-6

Dodd CS. Interventions for treating headlice. *Cochrane Database Syst Rev* 2001;(2):CD001165

Johnston GA. Treatment of bullous impetigo and the staphylococcal scalded skin syndrome in infants. *Expert Rev Anti Infect Ther* 2004;2:439-46

Websites

British Association of Dermatologists (www.bad.org.uk/doctors/guidelines)—Information and guidelines on management of common skin diseases

Cochrane Library (www.nelh.nhs.uk/cochrane.asp)—Provides information about evidence based medicine and research methods; excellent up to date information on evidence based treatment of skin disease

British National Formulary (www.bnf.org)—An excellent guide to prescribing topical and systemic antimicrobials in the clinical setting

Guidelines Finder (rms.nelh.nhs.uk/guidelinesfinder)—Details of over 800 UK national guidelines; updated on a weekly basis

Centers for Disease Control and Prevention (www.cdc.gov)—Up to date US information featuring fact sheets, frequently asked questions, and practical infection control steps

Clinical Evidence (www.clinicalevidence.com/cweb/conditions/skd/skd.jsp)—Summarises the current state of knowledge about the prevention and treatment of clinical conditions, on the basis of searches and appraisal of the literature

Clinical references

Harper J, Oranje A, Prose N, eds. *Textbook of pediatric dermatology*. Oxford: Blackwell Science, 2000 (excellent chapters on cutaneous infections of childhood)

Kane K, Ryder JB, Johnson RA, Baden HP, Stratigos A. *Color atlas and synopsis of pediatric dermatology*. New York: McGraw-Hill Medical Publishing, 2002

(outstanding picture book aid to paediatric dermatology)

Freedberg IM, Eisen AZ, Wolff K, Austen KF, Goldsmith LA, Katz SI, eds. *Fitzpatrick's dermatology in general medicine*. 6th ed. New York: McGraw-Hill, 2004 (flagship textbook with excellent chapters on cutaneous infections)

Burns DA, Breathnach S, Cox N, Griffith CEM. *Rook's textbook of dermatology*. 7th ed. London: Blackwell Science, 2004 (prestigious textbook with superb chapters on cutaneous infections)

Williams H, Bigby M, Diepgen T, Herxheimer A, Naldi L, Rzany B. *Evidence-based dermatology*. London: BMJ Publishing Group, 2003 (an excellent review of evidence based treatment of skin disease)

Royal College of Paediatrics and Child Health, Neonatal and Paediatric Pharmacists Group. *Medicines for children*. London: Royal College of Paediatrics and Child Health Publication, 2003 (an excellent reference about the use of medicines in children)

Useful websites for patients

British Association of Dermatologists (www.bad.org.uk/patients)—Information on the skin and how it works, as well as skin diseases
 American Academy of Dermatology (www.aad.org/public)—Contains useful information for patients
 Skin Care Campaign (www.skincarecampaign.org)—Website of an umbrella organisation representing the interests of all people with skin diseases in the UK
 OMNI (omni.ac.uk)—Offers free access to a searchable catalogue of internet sites covering health and medicine
 Dermatology (www.dermatology.co.uk/index.asp)—Educational resource relating to skin conditions and their treatment
 Centers for Disease Control and Prevention (www.cdc.gov)—Up to date US information featuring fact sheets, frequently asked questions, and practical infection control steps
 Prodigy (www.prodigy.nhs.uk/PILs/pilcondition.asp?ini=Infections)—Offers free access to many useful patient information leaflets

In this review, we focus on cold sores (herpes labialis) and exclude genital and neonatal HSV.

Primary herpetic gingivostomatitis is self limiting but can range in severity from virtually asymptomatic to severe infection with oral ulceration, sore throat, lymphadenopathy, pain, and fever. We recommend treatment of symptoms, topical aciclovir, and, if indicated, systemic aciclovir for 7–10 days.

Cold sores occur when latent HSV is reactivated. A prodrome of tingling and itching is followed by development of an erythematous plaque with grouped vesicles. Cold sores are usually localised and self limited, but they can be recurrent. Although they usually occur on the lip, they can occur anywhere on the face or body and are more difficult to diagnose at these sites. HSV is the most common cause of erythema multiforme,²⁶ but, more importantly, it can cause eczema herpeticum in patients with pre-existing atopic eczema.

Prophylactic oral antiviral agents may reduce the frequency and severity of cold sore attacks in adults.²⁷ Although no trials of prophylactic treatment have been done in children, those with confirmed frequent recurrences may also benefit from suppressive treatment. We suggest oral aciclovir 400 mg twice daily (half this dose for children under 2 years) for 6–12 months, depending on response. Topical aciclovir does not prevent recurrent attacks.²⁸

Erythema multiforme is an acute, self limiting, feverish eruption characterised by vesiculo-bullous target lesions (fig 4) in a symmetrical and acral distribution.²⁹ Spontaneous resolution occurs in a few weeks, but recurrences are frequent and oral involvement can impair quality of life. In recurrent erythema multiforme, early treatment of HSV with oral acyclovir may prevent erythema multiforme, but often treatment is started too late. For these children, prophylactic oral aciclovir may prevent episodes of both HSV and erythema multiforme, even when HSV is not the obvious precipitant of erythema multiforme.^{30 31}

Eczema herpeticum (Kaposi's varicelliform eruption) is a widespread HSV infection superimposed on pre-existing (often mild) atopic eczema. Widespread vesicles and erosions (fig 5), fever, and malaise occur. The first episode is the worst, and it can be recurrent. Mild cases can be treated with oral acyclovir, but more severe cases need admission to hospital for intravenous antiviral treatment. Treatment of the primary skin dis-

ease is essential (although topical steroids should be withheld during the acute phase), and antibiotics are indicated for secondary bacterial infection. Prophylactic oral aciclovir is indicated for recurrent disease.

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