General

Mites are related to ticks, scorpions and spiders. In contrast to insects they do not have antennae and their body is divided into two rather than three parts. Larvae have 6 legs and adult animals 8 legs. Mites tend to be much smaller than ticks. These animals occupy the most diverse ecological niches from *Varroa* mites which are found in the respiratory tract of honey bees to *Demodex* mites which colonise the sebaceous glands of human eyelashes. In humans ***Dermatophagoides*** *pteronyssinus*, is known as house dust mite. ***Sarcoptes scabiei*** causes scabies.

Some mite larvae belonging to the genus ***Leptotrombidium*** (belong to the harvest mites) transmit *Orientia (Rickettsia) tsutsugamushi* (scrub typhus) in Southeast Asia. Adult mites are of no direct medical importance as they feed exclusively on small invertebrates and insect eggs. A female lays 1-5 eggs per day on moist ground. After the larvae appear, they begin to crawl around actively on the ground, grasses, low plants, etc. Larvae attach themselves to a host when it passes through the vegetation and seek out a piece of skin that is soft, smooth and not too thick (peri-anal, groin, ankles). The very small larvae (150-300 µm) inject saliva and suck up the digested tissues. After 2-10 days the mites fall to the ground and dig themselves in for further development. The ecological habitat of these parasites is strictly defined. Optimal moisture of the soil, the right vegetation and sufficient hosts for the nymphs and adults (arthropods of various kinds), as well as the larvae (mostly rats and mice) need to be present. This results in a very scattered distribution and the existence of mite islands. These are areas where intense transmission of scrub typhus occurs, whereas no infections occur in places only a few kilometers away for instance. Although the potential zoonotic reservoir is not yet completely established, it is important to know that *Leptotrombidium* mites themselves serve as a reservoir for *Orientia tsutsugamushi* (transovarial transmission). Transmission of this kind can persist for several successive arthropod generations.

Scabies

Norwegian scabies on a foot of an AIDS patient. Copyright ITM

Norwegian scabies in HTLV-1 patient. Copyright Alexander von Humboldt Institute, Peru.

Scabies, genital nodules. These nodular lesions tend to disappear more slowly than other scabies lesions. Copyright ITM

Scabies is caused by ***Sarcoptes scabiei***. Morphologically similar mites are found on various animals (in dogs *Sarcoptes scabiei* var. *canis*) but do not permanently infect humans. Cat scabies is caused by *Notoedres cati*. "Milker's itch" is caused by *Sarcoptes bovis.Sarcoptes equi* occurs in horses and riders can suffer an itchy skin disorder from these mites. Scabies mites do not transmit any pathogenic organisms. Adult female *Sarcoptes scabiei* mites measure 400-600 µm, while the smaller males are slightly more than half this size. The cycle from egg to egg lasts 10 to 14 days.

Human-to-human transmission occurs directly or indirectly when hygiene is poor. The majority of mites are found on the wrists and fingers, with smaller numbers on elbows and elsewhere. The face is practically always spared. The mean number of female mites per infected person is 11, most having 1-15 mites. Only 3% of patients have 50 mites or more.

The mites dig burrows in the stratum corneum of the skin (1-5 mm per day). These tunnels are clinically very different from larva cutanea migrans. A female lays 1-3 eggs per day in her tunnel. Besides the eggs, mite faecal matter (scybala) is present in the tunnels. Larvae appear after 3-5 days. These crawl on the skin surface and many die there. Another 5-6 days later the adult appears which remains in situ if it is female. After becoming an adult and fertilisation by a passing male, the cycle can begin again. Female mites live on a person for 1-2 months. A female can produce up to 40 eggs in her life. Scabies causes pruritus, particularly at night. A definitive diagnosis is not straightforward as the characteristic skin tunnels usually only become visible after secondary infection or eczematous reaction. Scabies may trigger “unusual” impetigo (*Streptococcus pyogenes*). Repeated application of corticosteroid cream can lead to masking: “scabies incognito”.

Scabies provokes a papular, pruritic skin rash. There will be itching at sites where the mites themselves are found (e.g. between the fingers, wrists, elbows, genitalia). The rash is also seen on parts of the body that are not infested by scabies mites. Buttocks, groin, shoulders, arms, calves and ankles can become itchy. In classic scabies, the rash almost never occurs on the head, palms of the hands or soles of the feet. The rash is caused because the patient has become hypersensitive to mite allergens. In a patient who has never been exposed to scabies the rash usually occurs 4-6 weeks after infection. In previously exposed people it occurs much more rapidly, sometimes within just a few days. Despite effective treatment, symptoms and lesions of scabies can persist for weeks (e.g. scabies nodules on the scrotum and penis). Hypersensitivity to the scabies mite does not disappear immediately after the death of the parasite.

Sometimes **Norwegian scabies** occurs (“crusted scabies”). This condition is clinically totally different from classic scabies. A clinical description was first given in 1848 by Danielssen and Boeck in Norwegian leprosy patients. The condition occurs more frequently in immunosuppression e.g. AIDS and in infection with HTLV-1 than in the general population. Drug-induced immunosuppression, long-term topical steroid use and to a lesser extent a mental handicap such as Down’s syndrome increase the risk. In Norwegian scabies there are very numerous mites present in desquamating hyperkeratotic skin crusts. The latter can also occur on the face. The disorder is highly infectious. Sometimes tinea pedis, psoriasis, severe dyshidrosis, hyperkeratotic eczema, contact dermatitis or Darier’s disease (keratosis follicularis; autosomal dominant inheritance) resemble it. In case of doubt, it is sufficient to

examine some skin scales after treatment with 10% KOH under a low magnification microscope.

Scabies mites as yet exhibit no resistance to lindane or benzyl benzoate. For treatment, 20-30% benzyl benzoate is used, with which the whole body (except the face) is rubbed twice after washing with soap for 3 days. Lindane lotion (Quellada® = gamma-benzene hexachloride) can also be used but its use has been phased out because of toxicity concerns. This should be repeated after 7 days as the eggs are not killed by only one application. Pyrethroids are effective (e.g. 5% permethrin (Zalvor®). Malathion is best used as a lotion not as shampoo. Crotamiton (Eurax®) is also sometimes used but is less effective. Oral ivermectin (Mectizan®) also produces relatively good results, but should preferably be repeated after a few weeks. It is the first choice in Norwegian scabies. Linen and bedclothes are disinfected at the same time by water at >60°C. Washing bedclothes and clothing and ironing them with a steam iron during this period will also help break the cycle of transmission. Without access to a body the mites survive less than 4 days.

Guidelines for elimination of scabies in institutional outbreaks

- change encasings of mattresses, carpet, clothing
- cleaning rooms, furniture, couches
- topical and systemic treatment of patients (permethrin and ivermectin)
- synchronous topical treatment of all contacts with or without skin lesions
- clip nails, brush subungual folds with scabicides
- reduce social contacts, e.g. no reunions in nursing homes
- avoid pets, examine pets
- ten day quarantine of index patient
- caregivers should use gloves and protective clothing, alcohol and handwashing
- evaluate two weeks later for eventual retreatment