

Sarcoptes scabiei type *hominis*

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cellular organisms - Eukaryota - Fungi/Metazoa group - Metazoa - Eumetazoa - Bilateria - Coelomata - Protostomia - Panarthropoda - Arthropoda - Chelicerata - Arachnida - Acari - Acariformes - Sarcoptiformes - Astigmata - Psoroptidia - Sarcoptoidea - Sarcoptidae - Sarcoptinae - Sarcoptes - Sarcoptes scabiei - Sarcoptes scabiei type hominis

Brief facts

- *Sarcoptes scabiei* is a species of burrowing ectoparasitic mite that causes **scabies** in humans and **sarcoptic mange** in other animals. Specific variants of *S. scabiei* exist for humans and animals. Economically most important variants of *Sarcoptes scabiei* are **Sarcoptes scabiei type hominis** (human scabies), **Sarcoptes scabiei type canis** (dog sarcoptic mange), and **Sarcoptes scabiei type suis** (pig sarcoptic mange).
- The name *Sarcoptes scabiei* is derived from Greek **sarx** (flesh) and **korptein** (to smite or cut) and the Latin word **scabere** (to scratch). References to scabies are found in works of Aristotle and Cicero (described as "lice in the flesh"), in Bible, and in work of Shakespeare. Scabies is believed to be the first disease of man with a known cause when the mite was described by Italians Bonomo and Cestoni in 1689.
- *S. scabiei* is considered an important human and animal health problem world-wide, especially for indigenous populations in Australia, New Zealand, sub-Saharan Africa, and for immunocompromized individuals. Animal scabies

is considered a major cause of mortality amongst wild red foxes, coyote and the common wombat. Animal scabies can be transmitted to humans and cause skin eruptions and pruritus, however, in general, the disease is self-limiting and clears with time, because the mites cannot complete their life cycle.

Morphology

- *Sarcoptes scabiei* is a creamy white with brown legs and mouthparts. The adult female is about 0.4 mm long and 0.3 mm wide, the adult male is smaller in both dimensions approximately by one third.
- *Sarcoptes scabiei* are obligate parasites and live their entire lives and reproduce inside the host, protected from the environment by the host's tissues. They have no armor, no trachea, and no eyes, unlike their non-parasitic relatives.

Mite survivability

- Human and canine scabies mites can survive and remain infestive (capable of penetration) for 24-36 hours off-host under room conditions (21°C and 40-80% relative humidity). Lower temperature and high relative humidity may increase survival time up to 19 days for canine scabies mites. At temperatures below 20°C *S. scabiei* are virtually immobile whereas at 35°C their activity is greatly increased. Dislodged mites respond to host odor and thermal stimuli by actively seeking their source.
- Seasonable trends of occurrences of scabies that have been documented in the Israeli Army for over 20 years have shown a higher incidence of scabies in winter than in summer. This can be partly explained by increased survival rate of the mites in cooler temperatures in the environment away from the host, whereas, cold weather encourages overcrowding of the mite on the host. Mites also can be sensitive to human sweat that contains microbicides.

Transmission

- The mites cannot jump or fly, they can crawl as fast as 2.5 cm per min on warm skin while finding a mate or a suitable spot for burrowing.
- Mites are capable of skin penetration at any mobile stage (from larvae to adult). Skin entry takes about 30 min: the mite secretes enzymes that dissolve the skin, which is then ingested by the mite.
- Single gravid female or several larvae of differing sex are necessary for successful

infestation.

- Transmission most commonly occurs through direct relatively prolonged (up to 20 minutes) body-to-body contacts (hugging, sexual activities).
- It is difficult to get infected by scabies from the environment. Infection from clothing or bedding occurs very rarely: only about 1.33% of volunteers were infected by scabies after spending time in beds previously occupied by individuals with classical scabies (fewer than 20 mites per person).
- People with normal immune system develop some resistance to scabies and experimental re-infestation is difficult in sensitized individuals, and parasite load is usually lower than in naïve patients.

Clinical manifestations

- Common clinical manifestations include intense **pruritis** (itching) accompanied with various skin lesions produced by feeding female mites, their eggs, saliva, and excrements (**scybala**). In adults and older children the disease affects primarily web spaces, the axillae (armpits), elbows, wrists, genitalia, and lower buttocks although it can spread to cover the entire body. The symptoms usually occur with a delay of up to 4 weeks in naïve individuals (**delayed type-IV hypersensitivity reaction**). Previously sensitised individuals experience the symptoms within 24 hours after re-infection. The average infested human has an estimated 10 to 15 adult female mites on the body surface at any given time and about 11-12 are burrowing. In general, number of reproducing mites peaks in the first 3-4 months of primary infection, and drops dramatically when host develops sufficiently strong immune reaction.
- One of characteristics (or **pathognomonic** signs) of scabies infection is occurrence of burrows which are presented as whitish serpiginous (wavy) lesions in the upper epidermis measuring 0.3-0.5 mm in diameter by 10 mm in length. In practice, burrows are often obliterated by bathing and scratching, or, in case of severe infestations, by crust formation and secondary infection.
- In about 7% of patients the hypersensitivity reaction can manifest in **nodular scabies** where extremely pruritic reddish nodules of 2-20 mm in size are present on the male genitalia, buttocks, in the groin, and around armpits. The nodules do not contain mites and can persist for weeks after treatment.
- Some patients (especially immunocompromised, mentally retarded, or living in extreme poverty) experience an extreme form of the disease, **crusted or Norwegian scabies**, in which thousands of mites infest the skin causing severe crusting and **hyperkeratosis**. Skin samples from patients with crusted scabies can contain up to 4,700 mites per gram of skin. These patients can shed thousands highly infectious mites daily. In case of crusted scabies itching is usually not severe if present at all.
- Scabies in infants often manifests itself as vesicles, papules, and pustules that can

spread to areas that are atypical for adults: head, palms, soles, and behind the ears.

- **Bullous scabies** can be seen in elderly people. This atypical scabies manifests itself in **bullae** - blisters more than 5 mm in diameter with thin walls that is full of fluid.

Complications

- In the tropics, scabies is frequently associated with secondary bacterial infection (usually streptococcal or staphylococcal) of the lesions. Therefore, pyoderma and other complications characteristic of severe bacterial infection are possible including fatal **sepsis**.
- Substantial evidence exists that scabies is a risk factor for developing acute post-streptococcal **glomerulonephritis** (APSGN).

Characteristic distribution of lesions in adults with classic scabies.



Developmental stage (life cycle)

- **fertilized egg**

after mating, the male mite dies and the female starts to lay up to 3 eggs per day in skin burrows; a single female lays 10-25 eggs (up to 40) during its life time

- **hatching**

the larvae emerge 50-53 h after the eggs are laid

- **1st instar**

larval stage; the larvae differ from the nymphs and adults in only having six (not eight) legs; the larvae also dig burrows (so-called **molting pouches**)

- **1st molting**

the first molting occurs in 3 to 4 days after hatching

- **2nd instar**

also **protonymph**; the nymphs are similar to adult female or male but smaller

- **2nd molting**

protonymphs develop over 2 to 3 days and molt

- **3rd instar**

also **tritonymph**

- **3rd molting**

tritonymphs molt into adult male or female mites within 5-6 days (or about after a total 10-14 days after hatching)

- **adult mite**

adult mite capable of reproduction; less than 10% of eggs result in mature mites; the adult female reproductive stage can last up to 2-3 weeks, during which the female mite excavates a 1-cm-long tunnel in the skin epidermis (from **stratum corneum** to the boundaries of the **stratum granulosum**)

Treatment

Active agent	Formulation	Advantages	Disadvantages
Sulphur	2-10% precipitate in petroleum base	Safe for infants, pregnant and lactating women; cheap	Messy and malodorous; may cause skin irritation; multiple treatments are usually required
Crotamiton	10% ointment	Safe for infants; reported antibacterial and antipruritic activity; well tolerated	Multiple treatments are required; resistance reported
Benzyl benzoate	25% ointment	Effective; inexpensive	Can cause severe skin irritation; not ovicidal; multiple applications required; not recommended for pregnant and lactating women as well for infants
Lindane (gamma benzene hexachloride)	1% lotion or cream	Effective; inexpensive	Neurotoxic; contradicted in pregnant women and infants; resistance reported; banned in several countries
Permethrin (synthetic pyrethroid)	5% cream	Effective; well tolerated; first choice for pregnant women and infants	Expensive; resistance reported; mild skin irritation can occur
Ivermectin	Oral, 200 µg/kg	Broad spectrum antiparasitic; convenient; few side effects	Expensive; resistance reported; lack of sufficient safety data; optimal doses and regimen are uncertain
Natural pyrethrins and pyrethroids	Herbal oils and extracts (tea tree, neem, turmeric, bush tea)	Usually safe; high cure rates were shown at clinical trials	Lack of sufficient safety and efficiency data; multiple applications are usually required; can be quite expensive



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