REVIEW

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Clinical Diagnosis and Dermatological Clues in Scabies

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Abstract

Scabies, a globally prevalent parasitic infestation caused by *Sarcoptes scabiei hominis*, presents significant public health challenges, particularly in underdeveloped regions. Characterized by intense itching and distinctive rash patterns, scabies infestation requires prompt and accurate diagnosis to prevent outbreaks and additional health and economic burdens. The epidemiology of scabies underscores its high prevalence, particularly in conditions of overcrowding and poor hygiene, with an estimated 300 million cases annually worldwide. Transmission primarily occurs through prolonged skin-to-skin contact, and the risk is exacerbated in crowded living conditions and institutional settings. Clinical manifestations vary, with classic signs including burrows and intense nocturnal itching, and complications such as bacterial infections frequently arising. Diagnostic approaches range from microscopic examination of skin scrapings to non-invasive techniques like dermatoscopy and ultraviolet fluorescence. Effective management necessitates comprehensive treatment strategies, including the use of topical permethrin and oral ivermectin, emphasizing the need to treat all close contacts to curb reinfestation. Awareness and adherence to treatment protocols, alongside preventive measures, are crucial for controlling scabies outbreaks, reducing its public health impact, and improving the quality of life of affected individuals. This review highlights the importance of early detection, effective treatment, and public health strategies in managing scabies infestations, underscoring the need for increased awareness and action to address this neglected disease.

Keywords: Scabies, outbreak, diagnostic

INTRODUCTION

Scabies, also known as *Sarcoptes scabiei* infestation, is a disease caused by an infestation of the *Sarcoptes scabiei* mite, which can only live within human skin, and its main symptom is itching. Particularly in underdeveloped countries, scabies is a significant public health issue and has been declared a neglected skin disease by the World Health Organization. A classic presentation of scabies typically manifests as a characteristic distribution over the body and an intense itching rash. The diagnosis is confirmed by microscopic examination of scabies mites, eggs, or feces. Prompt diagnosis and the initiation of treatment in infected individuals are crucial. Incorrect or delayed diagnosis can lead to outbreaks, additional morbidity, and increased economic burden (1).

Etiology

S. scabiei hominis is an arthropod with eight legs, whitish in color, oval-shaped, and with a flat surface. Female mites have an average size of 0.4x0.3 mm, whereas male mites are half the size of females. After mating on the skin surface, male *sarcoptes* die. Female *sarcoptes* burrow into the stratum corneum and secrete proteolytic enzymes to create tunnels. A pregnant female continues to progress within the stratum corneum, laying 2-3 eggs per day and depositing their feces, known as *scybala*, between four to six weeks, until all eggs are laid, and then dies (2). Larvae hatch from eggs within 3-4 days and mature into adult mites within an average of 10-14 days. Scabies mites are highly sensitive to environmental temperature, losing their ability to move and penetrate the skin below 20 °C and dying in 10 minutes at temperatures above 50 °C. Mites can survive outside the host in ambient temperatures and humid environments for an average of 2-5 days.

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Epidemiology

Scabies is considered a significant public health issue with an estimated annual global prevalence of 300 million (3). Scabies infestation is particularly prevalent in regions with poor hygiene conditions and resource constraints. During wars, disasters, famines, overcrowding, poor nutrition, migration, homelessness, and similar circumstances, the parasite rapidly spreads, leading to scabies outbreaks. Transmission risk increases in crowded living conditions, resource-limited areas, childcare facilities, nursing homes, and other institutional settings (such as prisons and military barracks) (2). The incidence is higher during the fall and winter.

Transmission

Transmission of the parasite typically occurs through direct and prolonged skin contact, which can involve family members or sexual partners. The most significant transmission factor is close physical contact lasting 15-20 minutes (4). Although transmission through brief contacts is less likely in classic scabies infestations, it is possible even with short-term contacts of 1-2 minutes in crusted scabies cases. Because *sarcoptes* mites can survive for 2-5 days at room temperature after leaving the host, transmission through inanimate objects is also possible. The parasite that causes scabies in animals generally cannot survive in humans and does not cause scabies infestation (2,5).

Clinical Findings

Scabies is often seen in its classic form clinically, but it can present with different clinical findings and symptoms depending on the age of the host, current immunological status, or the presence of additional morbidities. Delayed type (type 4) hypersensitivity develops against the *sarcoptes* mite itself, its feces (*scybala*), and secretions in someone encountering *sarcoptes* for the first time. Healthy individuals who have experienced scabies infestation typically have 6-15 mites on their bodies. The main clinical feature of scabies is itching. Symptoms may appear in someone encountering the parasite for the first time within 3 to 6 weeks, but in cases of reinfestation, this period can be reduced to 1-3 days (6,7). Itching can worsen at night and be severe enough to wake the patient from sleep. Sweating and contact with hot water can intensify itching in patients with scabies.

Scabies' typical (specific) lesion, known as a burrow, appears as a serpiginous thread-like tunnel ranging from 2-15 mm in length, with a slightly raised, whitish, grayish, or brownish appearance on the skin (Figure 1). "Pearl vesicles", resembling grains of pearl, may be observed at the end or near the entrance of the tunnel. Although burrows can be visible to the naked eye, they may not be noticed because of secondary excoriation or infection (8). Lesions are typically distributed in the interdigital spaces, wrists, antecubital area, axillary region, penis, scrotum, buttocks, sacral area, periumbilical region, and areola areas in women. The imaginary area encompassing these regions is called the "Circle of Hebra". In healthy adults, the midline of the back, face, and hairy skin are spared, whereas in infants, the elderly, and immunosuppressed individuals, all skin surfaces are susceptible. Non-specific scabies lesions are polymorphic lesions characterized by symmetrical distribution and include papules, vesicles, bullae, pustules, nodules, and excoriations developed due to hypersensitivity (Figure 1).

In adults, areas typically unaffected, such as the head, neck, and palmoplantar region, are commonly affected in infants and children (9). In this age group, in addition to papules, vesicles and pustules are also more commonly observed; however, as scratching movements are limited, particularly in newborns and infants, excoriations are less frequent.

Nodular scabies is particularly observed in small children and the elderly and is characterized by round nodules ranging from 5-20 mm in size, which can be red, reddish-brown, or purple. Nodules are commonly found on the penis and scrotum, but they can also appear in the groin, perianal, and axillary regions (10). They are more prevalent in human immunodeficiency virus-positive patients. Nodules result from a deeper penetration of the scabies mite, leading to a stronger and longer-lasting local-allergic hypersensitivity reaction. Sometimes, ulcerations known as "scabetic chancre" can be observed in the genital area. Scabies nodules can persist for months even after successful treatment (post-scabetic papules) (11). Scabies mites are typically not observed in these lesions.

The bullous form of scabies, an atypical presentation, is also observed in children and the elderly. In the elderly population, this clinical picture can be confused with bullous pemphigoid. It should be considered if there is no response to topical corticosteroid treatment.

Figure 1. Specific lesion (left): burrow, non-specific lesions (right): pruritic papules

In individuals who are excessively meticulous about cleanliness and hygiene, scabies lesions may be indistinct. In addition, the anti-inflammatory effect of topical or systemic steroid use can suppress the formation of scabies lesions, leading to atypical presentations. This atypical clinical presentation is termed "scabies incognito". In this clinical scenario, although the lesions may be indistinct, there is usually no significant reduction in the severity of itching (12).

Crusted scabies (keratotic scabies/Norwegian scabies) is a severe form of scabies primarily observed in elderly, immobilized, mentally retarded, immunosuppressed, and Down syndrome patients, initially described in a patient with leprosy in Norway. While the typical scabies presentation involves an average of 12 *sarcoptes* mites, in this condition, there can be thousands or even millions of mites. Crusted scabies is one of the causes of erythroderma (13). In this clinical picture, widespread hyperkeratosis, fissures on the palms and soles, and irregularly thickened crusts are observed on the body (Figure 2). Thickening of the nails, subungual hyperkeratosis, discoloration, and dystrophy are present because of *sarcoptes* under the nails. Nail lesions can be mistaken for onychomycosis. Itchiness may be less prominent compared with classic scabies infestation because of a deficient immune response. Lymph node enlargement, peripheral blood eosinophilia, and elevated immunoglobulin E levels can be detected (14). This highly contagious condition can lead to major hospital outbreaks.

Secondary bacterial infections, such as impetigo, ecthyma, paronychia, and furunculosis, caused by *staphylococcal* or *streptococcal* bacteria are the most common complications of classic scabies clinical presentation. Impetigo due to *S. pyogenes*, scarlet fever, *streptococcal* toxic shock syndrome, rheumatic fever, and post-streptococcal glomerulonephritis are toxin-mediated diseases that can result from *streptococcal* infections. Fissures associated with crusted scabies provide an entry point for bacteria, which can lead to sepsis, particularly in elderly and immunocompromised patients. Generalized urticaria may rarely develop in patients with scabies.

Figure 2. Crusted scabies: hyperkeratotic thickened crusts and fissures

Diagnostic Methods

Various diagnostic methods are used to support the diagnosis of scabies. The sole definitive evidence for diagnosing scabies is the presence of mites, eggs, or feces (*scybala*). Skin scraping samples taken from lesions, particularly tunnels and burrows, rather than papules or nodules, can be examined under a microscope at 10x or 40x magnification to visualize adult female mites, eggs, or feces (Figure 3). Taking samples specifically from the tortuous termination part of the tunnel, where there are V-shaped scales, can increase the detection of mites and their products. For accurate and effective examination, it is recommended to puncture the burrow and tunnel with a needle, and after applying the contents to a slide, it should be examined under a microscope. The application of potassium hydroxide (KOH) can decrease the detection rate of parasites and compounds because of the rapid dissolution of mites and secretions in classic scabies. Therefore, except for crusted scabies, using saline or mineral oil instead of KOH application will increase diagnostic success (15). To increase the detection rate of mites, it is recommended not to take samples from a single lesion but to take multiple samples from different lesions. If mites are not detected, repeated samples should be taken if necessary. The absence of mites or compounds does not rule out the diagnosis. This sampling method, especially in children, may cause discomfort and decrease the success rate.

Skin samples can also be obtained using adhesive tape. This method relies on repeatedly applying and removing transparent, strong adhesive tape over the burrow and then transferring the collected sample to a slide for examination under a microscope. In microscopy, female *sarcoptes* mites are typically observed with dimensions of 0.4x0.3 mm, whereas male mites are less commonly encountered. The eggs are transparent, oval, uniform, and approximately 0.1 mm in size. Feces are brown and irregularly shaped, smaller in size than eggs, and are observed in clusters (3).

Figure 3. Microscopic image: adult mite at 40x magnification

A method similar to the tape method is described as superficial cyanoacrylate biopsy (SCAB), where cyanoacrylate is dripped onto the lesion and rapidly pulled off, and then the sample is examined under a microscope. SCAB also has the advantage of increasing the likelihood of distinguishing between live and dead mites, thus contributing to the evaluation of treatment success (16).

To better detect the burrow, the burrow ink test is applied. In this method, the suspicious papule and its surroundings are stained with ink, and the ink is then wiped off the lesion surface with an alcohol-soaked cloth to remove the ink from the lesion surface. In the case of a positive test, after wiping with alcohol, a dark, zigzag line is visible to the naked eye (17).

Dermatoscopy is an alternative, non-invasive, rapid, and sensitive assessment method. The sensitivity and specificity of dermatoscopy in diagnosing scabies are 98.3% and 88.5%, respectively (18). The triangle corresponding to the head, thorax, and front leg pairs of the *sarcoptes* mite is called the "delta sign". A linear or wavy line adjacent to it corresponds to the mite burrow. These two images together are referred to as the "jet and cloud" or "kite sign" (19) (Figure 4). The body of the mite is rarely visible because of its transparency. With this method, eggs and feces cannot be distinguished. However, after dropping blue ink into the burrows, polarized dermoscopy can be used to visualize the mite body and eggs (20).

Sarcoptes scabiei mite emits a bright reflection under ultraviolet (UV) light (21). A newly described dermatoscopy finding in recent years, called the "ball sign", refers to the portion seen as the delta sign in polarized dermoscopy appearing as a top shape due to the reflection it gives under UV-dermoscopy (22).

Wood's lamp is a practical and readily accessible diagnostic method that can be used to detect tunnels. When examined with a Wood's lamp in a dark room, tunnels emit bright yellow fluorescence. This allows for the easy detection of tunnels during both diagnosis and treatment follow-up processes (23).

Figure 4. Dermoscopic image: spesific sign "jet and cloud"

Video dermatoscopy (VD) allows for the visualization of tunnels and mites using magnifications ranging from 40 to 100 times. It provides higher sensitivity and specificity for diagnosis than skin scraping tests. Because it does not cause any discomfort to the patient, it can be easily used in non-cooperative patients as well. VD can also be used for the post-treatment follow-up of patients. In such cases, the presence of live mites indicates ongoing infection. In addition, it can be used as a screening tool for asymptomatic family members (24).

Optical coherence tomography is similar to ultrasonography but offers higher resolution. Tunnels, mites, and eggs can be visualized and examined in the patient's skin. It is primarily used as a research tool to study mite biology and monitor treatment (25,26).

Reflectance confocal microscopy (RCM) enables *in vivo* visualization of the skin horizontally from the epidermis to the dermis and can visualize the *sarcoptes* mite itself, its eggs, and fecal material. It is a non-invasive technique that scans different layers of the skin using the reflection of laser light. RCM allows visualization of the tunnel, which is seen as a linear segment in the epidermis, forming a "honeycomb" pattern. The biological behavior, peristalsis, and movements of the mite can be examined using RCM (27).

On histopathological examination, a mixed-type inflammatory infiltrate with widespread eosinophilia is often observed in the dermis, accompanied by edema and epidermal spongiosis depending on the type of elementary lesion from which the biopsy material is obtained. In addition, in nodular lesions, pseudolymphomatous changes may be observed. The mite itself, its eggs, and fecal remnants can be observed within the stratum corneum. In particular, when pink, pigtail-like structures representing egg fragments are observed, scabies is considered (28).

In the literature, ELISA, polymerase chain reaction, matrix-assisted laser desorption ionization time-of-flight mass spectrometry, and antigen detection systems are used in diagnosis; however, in practice, these tests are not commonly performed and some of them are quite costly (26).

A typical history, severe itching, and specific clinical findings form the basis of scabies diagnosis. However, in cases with particularly atypical clinical features, the above-mentioned ancillary diagnostic methods can be used. Recently, the International Alliance for the Control of Scabies used the Delphi method to classify scabies diagnosis into three levels based on

physical examination, history, and laboratory features: definitive diagnosis level A, clinical diagnosis level B, and suspected diagnosis level C (29) (Table 1) (29).

Informed consent was obtained from the patients in the clinical pictures.

Characteristics and General Recommendations of Scabies Treatment

When left untreated, itching can persist for weeks or even months, and the contagiousness continues. The most crucial step in effectively treating scabies is patient compliance. When developing a treatment plan for a patient diagnosed with scabies, it is mandatory for the family members and other individuals sharing the patient's living space to undergo treatment, even if they do not have symptoms, to prevent reinfestation (30,31). The absence of itching in other family members does not indicate the absence of contagion. All family members should be treated simultaneously. To control the disease, all sexual partners up to 6 weeks before the onset of the patient's symptoms should be treated and followed up, even in the absence of clinical symptoms. U.S. Food and Drug Administration approved topical permethrin and oral ivermectin as first-line treatments (32). In addition, alternative treatments include topical ivermectin, benzyl benzoate, sulfur, ivermectin, spinosad, crotamiton, malathion, and lindane.

Patients should be informed about the medication to be applied, the amount to be applied, the method of application, and the intervals of application in scabies treatment, and these instructions should be provided to the patient in written form. In fact, in recent meetings, the necessity of providing these applications to patients with short videos and digital programs has been emphasized.

If scabies treatment is provided topically, patients should take a shower before application. After showering, the body should be thoroughly dried and allowed to return to normal body temperature. The medication should then be applied to the entire body from the neck down, including the neck and behind the ears. In particular, in babies, crusted scabies, adults with immunodeficiency, or lesions on the scalp, the periorbital and perioral areas should be protected while the head area is included in the treatment area. During the treatment period, if the hands are washed, the medication should be reapplied to the hands.

Table 1. Summary of the 2018 International Alliance for the Control of Scabies criteria for the diagnosis of scabies

A: Confirmed scabies (if at least one of them is present): A1: Mites, eggs, or feces on light microscopy of skin samples A2: Mites, eggs, or feces visualized on an individual using a high-powered imaging device A3: Mite visualized on an individual using dermoscopy
B: Clinical scabies (if at least one of them is present): B1: Scabies burrows B2: Typical lesions affecting the male genitalia B3: Typical lesions in a typical distribution and two history features
C: Suspected scabies (if at least one of them is present): C1: Typical lesions in a typical distribution and one history feature C2: Atypical lesions or atypical distribution and two history features
History features H1: Itch H2: Close contact with an individual who has an itch or typical lesions in a typical distribution

Close contacts, family members sharing the same household, and sexual partners within the last 6 weeks, even if asymptomatic, must be treated, and all individuals should start treatment simultaneously. For those not exposed to the medication during the initial treatment or for the treatment of newly hatched mites from eggs, a second application is necessary 1-2 weeks later.

Especially within the last 3 days, clothing and items used should be considered contaminated and washed at a high temperature (>50 °C) for at least 10 minutes and then ironed with a hot iron. Items that cannot be washed should be kept in a sealed plastic bag for at least 72 h.

Patients should be called for follow-up appointments every 2 weeks and examined for the emergence of new lesions. In cases where new lesion development is observed despite repeated treatment, the adequacy of the aforementioned treatment practices and whether there has been contact with new infected individuals should be questioned.

In cases of recurrent infections despite all applications being performed correctly, drug resistance may be considered. Classic scabies patients can return to work or school with contact isolation 24 h after the initial treatment. However, patients with crusted scabies should be isolated until a cure is achieved.

In the first few days after treatment, temporary exacerbation of itching may occur because of immunological reactions and irritation from topical treatments. This should be explained patients and should not be considered as treatment failure. Because allergic sensitization to scabies mites and eggs developed up to 6 weeks after treatment (post-scabetic pruritus), symptomatic treatment with emollients, topical and systemic corticosteroids, and antihistamines may be required during this period. It is expected that itching will decrease and disappear over time.

Patients should be called for follow-up appointments 2 weeks and 1 month after the end of treatment to evaluate itching complaints and active lesions through physical examination. Furthermore, at the end of this period, patients who continue

to complain of itching, show no specific findings on physical examination, and do not respond to symptomatic treatments should be evaluated for parasite delusion.

CONCLUSION

As a result, it is important for the clinical features and diagnostic methods of scabies, which can cause epidemics, to be known not only by dermatologists but also by all healthcare professionals for public health. Recognizing and planning the treatment of the disease at the primary care level and taking preventive measures will not only prevent its spread and improve the patient's quality of life but also reduce workforce loss and provide economic benefits.

Ethics

Informed Consent: Informed consent was obtained from the patients in the clinical pictures.

Authorship Contributions

Surgical and Medical Practices: Y.Ö., N.Ö., İ.O.T., Concept: Y.Ö., N.Ö., İ.O.T., Design: Y.Ö., N.Ö., İ.O.T., Data Collection or Processing: Y.Ö., N.Ö., İ.O.T., Analysis or Interpretation: Y.Ö., N.Ö., İ.O.T., Literature Search: Y.Ö., N.Ö., İ.O.T., Writing: Y.Ö., N.Ö., İ.O.T.

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