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Review: Microbial Skin Infections (types, symptoms and methods of diagnosis)

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اصابات الجلد المايكروبية (أنواعها و أعراضها و طرق تشخيصها)

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ABSTRACT

Our body's largest organ for infection defense is the skin. The skin can occasionally catch an infection. Numerous different types of microorganisms can cause skin infections, which can range in severity from minor to severe. Skin conditions are very common anywhere in the world. It also includes all age groups for both gender and also depends on genetic factors, different environmental conditions, the pathogen and bacterial resistance to antibiotics as a result of indiscriminate use and other risk factors as injury to the skin, obesity, diabetes and eczema disease. Gram-positive bacteria are the most common cause of bacterial skin infections, as well as viruses, fungi and parasites, as these pathogens penetrate the skin through holes, hair follicles, wounds or animal bites such as insects. They are recognized as an issue with public health in developing nations. Our review deals with the route of skin infection, microbial causes of skin infection, their pathogenesis, the most important symptoms of these infections and laboratory diagnosis methods.

Conclusion: Since dermatitis is not limited to one microbial type without the other and can result from the normal flora when wounds or burns occur in the skin, serious skin infections and their symptoms vary depending on the type of microbial cause and what it secretes from toxins or other virulence factors.

Key words: Skin, Skin diseases, Microbial skin infection, bacterial skin infection

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INTRODUCTION

Bacteria, viruses, fungi and parasites are all possible causes of microbial skin disorders. Group A -hemolytic streptococci and *Staphylococcus aureus* are the most frequent bacterial skin pathogens. The most prevalent viral skin condition is *Herpes simplex*. Dermatophytic fungi, *Trichophyton rubrum* is the most common cause of skin and nail infections [1].
Significant rates of skin diseases are seen all over the world. It has been recognized as a public health problem in underdeveloped countries. They are widespread throughout Africa and are caused mostly by superficial bacterial and fungal infections [2]. Eczema is a common disease that can help to cause the skin infection, Discoid lupus erythematosus is also widespread in various regions, and lichen planus is more common there than in temperate countries.

Route of infection:

Skin (pores, hair follicles) is the first point of entry; Also, rodent bites are responsible for spreading many diseases, such as the bubonic plague (the Black Death), which is a bacterial disease that affects rodents and can spread to humans and other animals through infected rat fleas. People get plague from the bites of a rodent flea that carries the plague bacteria (*Yersinia pestis*), Wounds (burns, cuts, and scrapes) and animal and insect bites [4].

The four most prevalent kinds of skin diseases:

1. Bacterial skin infections: -

Bacteria cause many skin infections, which often appear in the form of small red blisters on the skin that gradually become larger in size. Some types of bacterial infections can be treated well with topical antibiotics, but others need treatment with oral medications [5].
There are many bacterial skin infections include:

1. Cellulites:

Is a common bacterial skin infection, usually affects the arms and legs. It can also develop around the eyes and mouth that causes redness, swelling, and pain in the infected area of the skin. *S. pyogenes* and *S. aureus* may be implicated in cellulitis, Septicemia can result from an infection that spreads via the lymphatic and blood vessels [6].

2. Impetigo:

Staphylococcus aureus, Group A-hemolytic Streptococci, or both may cause lesions of common or superficial impetigo, and it is debatable whether of these organisms are the predominant pathogen [7].
A more severe forms of impetigo is ecthyma. Lesions commonly develop as a result of debility and infestation and typically affect the legs and other normally covered parts of the body[8].

3. Staphylococcal scalded skin syndrome (SSSS):

Lyell's illness, are also known as Staphylococcal scalded skin syndrome (SSSS), or toxic epidermal necrolysis, begins as a localized lesion and progresses to a widespread erythema and skin exfoliation[9]. This syndrome is brought on by phage group II staphylococci that release an epidermolytic toxin. Infants are more likely to get the illness than adults [10].

4. Boils:

Staphylococcal follicular infection involving subcutaneous tissues. The regions that are hairy or exposed to friction and macerations are the optimal locations for furuncles. A big, painful lesion that is indurated and has numerous draining points is called a carbuncle[11].

Pathogenesis of bacterial infection:

When bacteria infect the body after breaching the skin through an incision or scrape, the infection happens. A sickness or a drug side effect may cause a weakened immune system [12].

The categorization of bacterial skin diseases (pyodermas) is an effort to organize and integrate different clinical entities. For primary and secondary bacterial illnesses an arbitrary is also helpful categorization [13].

Primary Infections:

A single pathogen causes primary skin infections, which frequently affect normal skin and have a distinct clinical appearance and disease history, they are most frequently caused by *Staphylococcus aureus*, and *Streptococcus pyogenes*. Common kinds include boils, folliculitis and impetigo [14].

Secondary Infections:

Wet and damaged skin is an opportunistic environment for the growth of various bacteria, causing secondary skin infections, for example infections of the folds and toes. The clinical characteristics and development of these infections differ depending on the underlying illness, Intertrigo and Eczematoid Dermatitis are examples [15].

Intertrigo:

Intertrigo is most frequently observed in obese individuals or newborns. Erythema, maceration, or even erosions are brought on in the skin fold by heat, moisture, and friction. Overgrowth of resident or transient flora may produce this problem [16].

Acute Infectious Eczematoid Dermatitis:

A boil, dripping ear, nose, or any other primary lesion that produces infectious exudate, is the cause of acute infectious eczematoid dermatitis. The organisms that are frequently isolated are coagulase-positive staphylococci bacteria [17].

Other Bacterial Skin Diseases:

Streptococcal skin infection:

Streptococcal infections spread subcutaneously, and lead to the following conditions [18]:

- **Cellulitis** mostly caused by *S.pyogenes* and *S.aureus* may involved
- **Impetigo** seen in young children; vesicles appear on the skin around the mouth which caused by group A Streptococcus and Staphylococcus aureus
- **Necrotizing fasciitis (streptococcal gangrene)**: Infection spreads quickly and affects the skin's fascial planes as well, leading to necrosis and tissue loss. At first, the skin seems normal, but as the infection advances along the fascial planes, it chokes off the skin's blood supply. After that, the skin becomes brown and becomes necrotic; the patient may then go into shock and pass away within 24 hours caused by mixed flora including staphylococci, strict anaerobes and Enterobacteriaceae; the major causative organism is *S. pyogenes* [19].

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Skin Tuberculosis (Localized Form):

When Mycobacterium tuberculosis is injected into a wound, people without any prior immunologic encounter with the illness may develop localized skin TB. The patient's resistance to therapy and the success of that treatment determine how the disease develops [20]. Two main kinds of cutaneous lesions in an immune or partly immune host are differentiated: tuberculosis verrucosa and lupus vulgaris.

Acne: disfiguring facial infection of adolescents caused by Propionibacterium acnes.

Leprosy: caused by *Mycobacterium leprae* which transmitted by prolonged contact lives in skin and nerves and cause lepromatous and tuberculoid leprosy [21].

Erythrasma:

A persistent superficial infection of the skin's intertriginous regions. It is brought on by the Coryne bacteria minutissimum, which normally exists as part of the skin's natural flora. A warm, muggy environment, obesity and diabetes are risk factors. It frequently affects adults [22].

2. Viral skin infections:

Localized and widespread skin infections are both possible outcomes of viral skin disorders. From moderate to severe these illnesses. The three viral families that are most prevalent are the poxvirus, human papillomavirus, and herpes virus. Human herpes viruses 1 and 2 cause recurrent cold sore and genital lesions herpetic [23].

There are various viral illnesses, including:

A. Shingles (herpes zoster):

Varicella-zoster virus reactivation results in the localized, painful, blistering rash known as herpes zoster (VZV). The blisters of herpes zoster are restricted to the cutaneous distribution of one or two nearby sensory nerves, a condition known as dermatomal distribution, the virus affects children and the peak incidence among children of preschool and school age, as the disease usually occurs in late winter and early spring. Herpes zoster is also called shingles [24].

B. Chickenpox:

The herpesvirus family's varicella-zoster virus, which is the primary cause of chickenpox, infects people. On the stomach, back, and face, chickenpox typically starts as itchy red papules that develop into vesicles before spreading to other regions of the body. There are also oral blisters that can develop [25].

C. Molluscum contagiosum:

The poxvirus that causes Molluscum contagiosum is characterized by a large number of tiny, pink nodules, which most frequently appear on the face, genitalia, or the rectal region. Generally speaking, the illness is mild and self-limiting [26].

D. Warts:

Warts are brought on by human papillomaviruses. On hands and fingers, verruca vulgaris frequently manifests as a single lesion or a cluster of lesions. These warts are typically solid, dry, and scratchy, with little to no pain. They could stay the same or unexpectedly regress. On the bottom of the foot, verruca plantaris, a clinical variation of verruca vulgaris, appears (plantar wart) [27].

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E. Measles:

The measles virus, a member of the morbilli virus family, is what causes the disease. Measles is a virus that causes fever, rash, and is extremely contagious. The mouth may have little white dots. Over the following few days, a red blotchy rash develops on the face, progresses to the trunk, and generalizes [28].

F. Hand, foot and mouth disease:

Children frequently contract hand, foot, and mouth disease (HFMD), a contagious infection that results in blisters or rashes on their hands, feet, legs, or buttocks as well as sores within or around their mouths known as ulcers. Although unpleasant, it is not a dangerous condition. Coxsackie virus a 16 and enterovirus 71 are the viruses that typically cause hand, foot, and mouth [29].

3. Fungal skin infections:

These skin diseases are fungus-based and most frequently appear in moist body regions like the armpit or feet. Certain fungi infections are not contagious, and they usually do not pose a serious threat to life. Fungi grow in warm, moist environments. Antibiotics affect fungal infections in two main ways: first, as antifungal agents and second, they expose the body to new types of invasive fungal infection, for example *Candida albicans* which causes thrush, especially in children, and a genital infection in adults. A risk factor for skin infections is wearing moist or sweaty clothing. Through a skin fissure or cut, bacteria can get into the deeper layers of the skin [13].

Between the toes, in the vaginal region, and under the breasts are examples of wet body regions where skin surfaces converge and are frequent habitats for fungi. Yeasts (like Candida or Malassezia furfur) or dermatophytes (such Epidermophyton, Microsporum, and Trichophyton) are the main culprits behind common fungal skin infections. Several of these fungi are restricted to living in the stratum corneum, the epidermis' uppermost layer [30].

The common types of fungal infections:

3.1. Mold disease:

A. ATHLETE'S FOOT (TINEA PEDIS)

The most prevalent fungal skin infection, athlete's foot, develops when feet perspire and heated moisture builds up, particularly on the skin in the spaces between the toes. The most typical cause is a fungus from the genus *Trichophyton* [31].

B. BODY RINGWORM (TINEA CORPORIS)

Wherever on the body, ringworm can develop and spread to other body areas and to those in close physical touch with the initial patient. Typically, fungi from the genera *Trichophyton or Microsporum* are responsible for this infection. [32].

C. Jock Itch (Tinea Cruris):

A dermatophyte (fungal) infection of the groin is known as jock itch. Dermatophytosis includes tinea cruris. Tinea cruris symptoms include an itchy, possibly painful rash. The infection starts in the vaginal skinfolds and can progress to the upper inner thighs. It can

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also happen on both sides. Normally the scrotum is not affected or is just mildly affected. The rash has a scaly, pink border [33].

D. Tinea Capitis (Scalp Ringworm):

The scalp is infected with dermatophytes in tinea capitis. The most frequent cause is *Trichophyton tonsurans* causes baldness, dry scale patches, or both, to gradually emerge. Black dot ringworm which is brought on by *T. tonsurans* infection causes hair shafts to split at the scalp's surface [34].

3.2. Yeast Infection:

Candidiasis is the most prevalent kind of yeast infection in human skin. Candida species infection causes candidiasis. There are over 20 different species of Candida. ***Candida albicans*** is the most prevalent. All of the surfaces of our bodies are home to these fungi, although they rarely cause infection [35].

- **Perlèche** is a softening of the skin with deep creases around the angles of the mouth. (Also known as angular cheilitis).
- **Thrush** is a throat and mouth infection caused by candida. The mouth develops white spots. Thrush most frequently affects persons with chronic illnesses like cancer, diabetes, and HIV/AIDS.

4. Parasitic skin infection

There is a parasite that causes these kinds of skin diseases. These infections can enter the circulation and organs after starting on the skin. Little insects or worms that burrow into the skin to dwell there or lay their eggs are the most common types of parasites that affect the skin [36].

Ascaris lumbricoides is the parasite that has been linked to skin allergy symptoms the most commonly in our area. The two main skin symptoms of parasite infestation are acute angioedema and persistent rash [37]. Different types of parasitic skin infections include:

A. Scabies infection:

This is a skin condition brought on by a microscopic creature known as a mite, Sarcoptic scabies. The skin becomes irritated and extremely uncomfortable as the female burrows into it to lay her eggs. As a result, they frequently scrape their skin [38].

B. Leishmaniasis:

An intracellular protozoan parasite (genus *Leishmania*) that causes leishmaniasis is spread via the bite of a female phlebotomy sand fly. Most of the affected countries are in the tropics and subtropics, in Iraq the highest infection case was observed in the middle and west of Iraq (53%) while the lowest reported cases were observed in the North of Iraq (1%) [39] Leishmaniasis has a wide range of clinical manifestations, including self-healing skin ulcers, mutilating mucocutaneous diseases, and even fatal systemic illnesses [40].

Symptoms of a skin infection:

Depending on the kind of skin infection, the symptoms also change. Typical symptoms include a rash and skin redness. There may also be additional signs like itching, pain, and tenderness. Skin infections have the potential to enter the bloodstream [41]. When this occurs, life can be at jeopardy. Pus, blisters, skin sloughing or breakdown, dark, necrotic-appearing skin, or skin that turns discolored and hurts are indications of a severe infection [42].

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Laboratory tests for bacterial infections may include:

- Total blood count: Neutrophils and white blood cells commonly increase in response to bacterial infections.
- C-reactive protein (CRP): severe bacterial infections result in a rise of 50 or more.
- Procalcitonin is a blood test that can detect widespread sepsis brought on by bacteria.
- Polymerase chain reaction (PCR) and ELISA testing for specific species; serology: assays to detect the immune response to a specific pathogen, performed 10 days apart
- A swab of the painful location, such as the throat or skin lesions, for culture
- Blood culture: if high fever > 38C.

Conflict of interests.

There are non-conflicts of interest.

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الخلاصة

يعتبر الجلد العضو الاكبر للجسم الذي يحميه من الاصابة بالعدوى الميكروبية, في بعض الاحيان قد يصاب الجلد ذاته بالميكروبات و هنالك عدد كبير من الميكروبات التي تصيب الجلد و تتدرج أعراض الاصابة من طفيفة الى شديدة الخطورة وتحصل هذه الاصابة على مستوى واسع في العالم اذ تشكل هذه الاصابات مشكلة صحية عالمية في البلدان المتطورة كما تشمل جميع الفئات العمرية لكلا الجنسين وتعتمد ايضا على العوامل الوراثية و الظروف البيئية المختلفة والكائن الممرض ومقاومة البكتريا للمضادات الحياتية نتيجة الاستخدام العشوائي وغيرها من عوامل الخطر كإصابة الجلد، والسمنة، والسكري، ومرض الأكزيما. تعتبر البكتريا الموجبة لصبغة كرام هي المسبب الاكثر لاصابات الجلد البكتيرية والفيروسات والفطريات والطفيليات اذ تخترق تلك العوامل الممرضة الجلد عن طريق الثقوب او بصيلات الشعر او الجروح او لدغة الحيوانات كالحشرات حيث تعرف كمشكلة مهمة صحيا في البلدان النامية. تناول البحث الحالي دراسة طرق دخول الميكروبات للجلد والمسببات الميكروبية للاصابات الجلدية و امراضيتها وأهم أعراض تلك الاصابات وطرق تشخيصها مختبريا.

الكلمات المفتاحية : الجلد , الامراض الجلدية , التهابات الجلد الميكروبية , اصابات الجلد البكتيرية