Dermatophyte Infections: A Fungus Among Us?

ABSTRACT

Superficial fungal infections are a common occurrence in adults and children alike. Dermatophytes are the primary cause of these infections, which generally present as erythematous, scaling, annular lesions. Also referred to as "tinea", these infections are classified based on where they are found on the body, as different locations can have slightly different presentations and treatment requirements. This article provides an overview of these various presentations of dermatophyte infections and their risk factors, as well as recommended therapies.

KEYWORDS: dermatophytes, fungal infections, therapies

Introduction

Dermatophytes are a specific type of fungus that feeds on keratin. Keratin is a protein that is found on superficial skin, nails, and hair, where these infections tend to occur. Dermatophyte infections are the most common type of superficial fungal infections.[1] They are most commonly spread from person to person (anthropophilic), but can also be spread to humans from soil (geophilic), animals (zoophilic), or fomites. It is not unusual for these infections to spread from one infected part of the body to another. Dermatophyte infections do not involve mucosal surfaces. The most common pathogens in these types of infections are *Microsporum, Trichophyton,* and *Epidermophyton*.[2] Diagnosis is often based on clinical suspicion in addition to potassium hydroxide microscopy, fungal cultures, and sometimes Wood's lamp examination. When dermatophyte infections are treated with topical corticosteroids, they become harder to detect. This is known as tinea incognito.

Tinea Capitis

A dermatophyte infection of the scalp is referred to as tinea capitis. In North America, this is often caused by *Trichophyton tonsurans*. Another source is *Microsporum*

ABOUT THE AUTHORS

Miriam Armanious, BSc, MD candidate, *Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Ontario*

Joseph M. Lam, MD, FRCPC, *Clinical Associate Professor, Department of Pediatrics, Associate Member, Department of Dermatology and Skin Sciences, University of British Columbia, Vancouver, BC.*

canis, which is harboured by cats and dogs. *M. canis* is a common causative dermatophyte in European and Mediterranean countries.[3] Tinea capitis is commonly found in the pediatric population, with a peak incidence between 3 and 9 years of age.[4] It is most common in people of African descent. Tinea capitis can present in different ways; the scalp can be dry and flaky in some instances, while in others there can be a crusted, matted look to the hair. Tinea capitis can also be accompanied by alopecia (Figure 1). While there can be smooth areas of hair loss, usually there are patches showing a "black dot" pattern where the roots of the hairs are still present due to breakage of the overlying hair shaft. In severe cases, an abscess called a kerion can present (Figure 2). This crusting, pustular, inflammatory plaque is caused by a hypersensitivity response to fungal antigens.

Systemic antifungal treatment is required for tinea capitis in order to penetrate to the base of the hair follicles. Topical antifungals can be used adjunctively, but are ineffective on their own. One commonly used antifungal agent is terbinafine. Dosing of oral terbinafine in pediatric populations is weight dependent. For children under 25kg, 125mg/day is recommended. For children between 25 and 35kg, the dose is 187.5mg/day. Children over 35kg can take the adult dose of 250mg/day.[5] Tinea capitis

Figure 1: Tinea capitis that is also accompanied by alopecia

should be treated for four weeks if responding well. Griseofulvin can also be used to treat tinea capitis, although it is no longer available in Canada. The recommended dose is 10-25mg/kg/day for 8 weeks.[6]

Tinea Faciei

This infection occurs on glabrous facial skin, which refers to smooth areas producing vellus hairs, such as on the forehead. Tinea faciei presents as annular, erythematous patches that can be mistaken for eczema (Figure 3). It is not as

Figure 2: An example of an abscess called a kerion

scaly as other presentations of tinea and is difficult to spot on pigmented skin. Treatment is topical terbinafine. If the infection does not respond, oral terbinafine can also be prescribed.[7]

Tinea Barbae

Tinea barbae occurs in the skin and hairs of the non-glabrous areas of the face, typically around the beard and moustache area. It presents as erythematous plaques with scaling and pustules. Unlike bacterial infections in this area, tinea barbae does not cause pain with shaving. The recommended treatment for adults is 250mg of oral terbinafine daily for 2-4 weeks.

Tinea Corporis

This type of infection, commonly referred to as "ringworm", is prevalent in both adults and children. These terms refer to dermatophyte infections on the trunk, arms, and legs. The most common pathogen is *Trichophyton rubrum*.[8] Tinea corporis often presents as annular, erythematous, scaling lesions with central clearing (Figure 4). These lesions may or may not be pruritic, and pustules may be present around the outer border. Most cases can be managed by keeping the area dry and applying topical 1% terbinafine.

Majocchi's Granuloma occurs when tinea corporis is left unmanaged and the dermatophyte infection spreads deeper into the hair follicles (Figure 5). The most common causative organism is *T. rubrum*, but this can also be caused by *T. mentagrophytes, T. epilans, T. violaceum, Microsporum audouinii, M. canis, M. gypseum, and M. ferrugineum*.[8] Risk factors include an immunocompromised state, trauma to the area (e.g. shaving), and use of topical corticosteroids. Like tinea capitis, oral anti fungal treatment is required. The recommended regimen is 250mg/kg oral terbinafine for 1-6 months depending on severity.[9]

Figure 3: Tinea Faciei presenting as annular, erythematous patches

Figure 4: Tinea corporis presenting as annular, erythematous, scaling lesions with central clearing

Tinea Pedis

Tinea pedis is also commonly referred to as "athletes foot". These infections are often caused by *T. rubrum, T. interdigitale,* and *Epidermophyton floccosum*. This is usually spread through direct contact (e.g. walking barefoot in a moist area). This infection can present in different ways:

Interdigital: White scaling and fissuring of skin between toes (Figure 6)

Moccasin/Hyperkeratotic: Thickening and scaling of skin on plantar surface (Figure 7)

Vesiculobullous: Formation of vesicles, pustules, and bullae on feet

Therapy involves topical terbinafine. A keratolytic agent, such as 40% urea cream, can be added in the case of hyperkeratotic tinea pedis.[10] This reduces scaling on the feet and improves the absorption of antifungal agents. Oral therapy is not indicated unless the infection is refractory to topical treatment. These infections may give rise to cellulitis if not managed appropriately. It is important to inspect the patient's nails as tinea pedis often gives rise to onychomycosis.

Tinea Manuum

This refers to dermatophyte infections of the hands. This is commonly a result of the spread of an al-ready existing tinea pedis. Tinea manuum is often found in a "2 foot and 1 hand" distribution. It presents as dry, thickened, scaling skin and may also spread to the fingernails. Treatment for tinea manuum involves topical 1% terbinafine and emollients.

Figure 5: Majocchi's Granuloma occurs when tinea corporis is left unmanaged and the dermatophyte infection spreads deeper into the hair follicles

Tinea Cruris

Also known as a "jock itch", this dermatophyte infection in the groin area is most commonly caused by *T. rubrum*. While this tends to present predominantly in males, it can still be found in female patients. The likelihood of having this infec-

Figure 6: Tinea Pedis presenting as interdigital: white scaling and fissuring of skin between toes

Figure 7: Tinea Pedis presenting as Moccasin/Hyperkeratotic: thickening and scaling of skin on plantar surface

Figure 8: Tinea Cruris presents as erythematous, scaling lesions with raised borders. There can be vesicles and/or pustules present

tion during childhood is low, but increases towards adolescence and adulthood. Risk factors include excessive sweating, obesity, an immunocompromised state, and diabetes. It presents as erythematous, scaling lesions with raised borders (Figure 8). There can be vesicles and/or pustules present. The scrotum is spared. This can be spread from tinea pedis. Treatment is typically topical terbinafine with systemic antifungal therapy reserved for refractory cases.

Tinea Unguium/Oncyhomycosis

Onychomycosis is a general term to describe a fungal infection of the nails. Tinea unguium is a term for a specific type of onychomycosis, used exclusively when the nail infection is caused by dermatophytes. This infection presents as thickened nails that lift off of the nail bed (Figure 9). This diagnosis of tinea unguium should be confirmed with a nail clipping sent for KOH microscopy, PAS staining, and/or culture. These infections can become chronic as they are difficult to eradicate. An antifungal nail polish can be used, such as cicloporox, enfinaconazole, or tavaborole. The literature suggests that the newer agents, enfinaconazole and tavaborole, are more effective at treating tinea unguium than cicloporox, which was the only agent available for many years.[11]

Figure 9: Tinea Unguium/ Oncyhomycosis presents as thickened nails that lift off of the nail bed

Oral therapy is also recommended. Adults are treated with 250mg per day of oral terbinafine for 6 weeks if the infection is in the fingernails, and 12 weeks if it is present in the toenails.[12] Oral terbinafine is also used off label to treat tinea unguium in children (See Table 1).[13] This agent is not effective for non-dermatophyte onychomycosis.

Tinea Imbricata

This dermatophyte infection is rarely found in North America, but is endemic to areas of South America, Central America, and the South Pacific. This infection is caused by Trichophyton concentricum, and presents as erythematous, scaling lesions arranged in a unique concentric pattern. It is often pruritic and can cover any part of the body. Recommended treatment is oral terbinafine.

Table 1: Guidelines for Adult Oral Antifungals[13,14]

Terbinafine:	250mg/day
Itraconazole:	200mg twice daily
Fluconazole:	150mg-300mg once a week
Ketoconazole:	200–400 mg/day

Table 1: Guidelines for Pediatric Oral Antifungals:

Terbinafine:	<25kg: 125mg/day 25-35kg: 187.5mg/day >35kg: 250mg/day
Griseofulvin:	Microsize: 20–25 mg/kg/day Ultramicrosize: 10-15 mg/kg/day
Itraconazole:	10-15 kg: 100mg every other day 16-20kg: 100mg daily 21-40kg: 100mg twice daily >40kg: 200mg twice daily
Ketoconazole:	3.3 to 6.6 mg/kg/day

FUN FUNgus Fact

Tinea corporis gladiatorum is a specific term for tinea corporis that is spread through skin to skin contact between wrestlers

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Summary of Main Types of Infection

Tinea capitis –	scalp
Tinea corporis –	trunk, arms, legs
Tinea cruris –	groin area
Tinea pedis –	feet
Tinea manuum –	hands
Tinea barbae –	beard/moustache distribution
Tinea faciei –	glabrous skin of face
Tinea unguium –	nails

SUMMARY OF KEY POINTS

Dermatophyte infections, also known as tinea, are very common fungal infections in humans. They occur on the superficial skin, hair, and nails, and can present in many different locations on the body.

Tinea captis is most common in children and can cause hair loss or abscess formation.

When tinea infections are treated with topical corticosteroids, they become harder to detect and are referred to as tinea incognito.

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CLINICAL PEARLS

Tinea infections are common, but should be confirmed with KOH microscopy and/or culture from a skin scraping, nail clipping, or hair sample.

Tinea capitis can be mistaken for eczema or seborrheic dermatitis

Check patients who have tinea infection for tinea pedis, since this is a common source of infection for sites on the rest of the body

Treatment for dermatophyte infections can include oral antifungal agents such as terbinafine or grise-ofulvin in a weight-dependent dose, or topical antifungal agents. Systemic agents are generally re-served for presentations that penetrate hair follicles and nails, or those that are refractory to topical treatment.