Dermatophytosis (Tinea Infections)

Introduction \[1\]

Dermatophytosis (tinea) infections are fungal infections caused by dermatophytes - a group of fungi that invade and grow in dead keratin. Several species commonly invade human keratin and these belong to the *Epidermophyton*, *Microsporum* and *Trichophyton* genera. They tend to grow outwards on skin, producing a ring-like pattern - hence the term ‘ringworm’. They are very common and affect different parts of the body. They can usually be successfully treated but success depends on the site of infection and on compliance with treatment.

See separate Tinea Capitis, Fungal Nail Infections, Pityriasis Versicolor and Candidiasis articles.

Pathophysiology \[2, 3\]

- Infection is limited to the dead layers of skin but encouraged by a damp and warm local environment.
- The infection can be transmitted to humans by anthropophilic (between people), geophilic (from soil) and zoophilic (from animals) spread.
- The most common organisms are:
  - *Trichophytons rubrum*, *Trichophytons tonsurans*, *Trichophytons interdigitale* and *Trichophytons mentagrophytes*.
  - *Microsporum canis*.
  - *Epidermophyton floccosum*.

- Clinical classification is according to site:
  - Scalp - tinea capitis.
  - Feet - tinea pedis.
  - Hands - tinea manuum.
  - Nail - tinea unguium (or onychomycosis).
  - Beard area - tinea barbae.
  - Groin - tinea cruris.
  - Body including trunk and arms - tinea corporis.

Epidemiology

Infection is very common all over the world. Some types are more common than others, with tinea pedis being most common in adults and tinea capitis the most common in children. Onychomycosis is also extremely common.

The Royal College of General Practitioner’s Birmingham Research Unit reported an annual incidence of dermatomycosis of 16 per 10,000 persons (age standardised).\[4\] A survey of 15,333 dermatophytes obtained from a UK reference laboratory from 1980 through 2005 found that the relative frequencies of isolations of *M. canis* (cat and dog ringworm), *Trichophyton verrucosum* (cattle ringworm), *T. mentagrophytes* (rodent ringworm) and *E. floccosum* (a cause of human groin and foot infections) all decreased by 90%. However, the contributions of *T. tonsurans* and *Trichophyton violaceum* (two anthropophilic scalp-infecting species) to total dermatophyte isolations increased by 1000% over the same period. *T. rubrum* and *T. interdigitale*, the two common causes of foot infection, comprised 80% of all dermatophytes isolated in 1980 and 90% of isolations in 2005.\[5\] Tinea cruris is three times more common in men than in women because of the scrotal anatomy. It is a very common condition and has a higher prevalence in countries with hot humid climates. *T. rubrum* is the most common organism in the UK.\[5\]
Presentation[^2]

History
- Itching, rash and nail discolouration are the most common symptoms of tinea infection.
- Hair loss occurs with tinea capitis (mainly a disease of children).
- Complications such as secondary infection (cellulitis and impetigo) can lead to symptoms.
- It is common in people who play contact sports.
- It occurs in immunocompromised patients.

Examination
- Tinea pedis:[^6]
  - It particularly affects the web of the toe where skin may be macerated and erythematous.
  - It commonly affects the plantar surface of the foot. Erythema, vesicles and pustules can occur.

![Image of tinea pedis](image)

- Tinea capitis:[^7]
  - It can cause hair loss with broken hairs at the surface (as distinct from alopecia areata).
  - Clinical appearance is variable.

- Tinea unguium (onychomycosis):[^8]
  - Onycholysis or separation of the nail from the nail bed commonly occurs.
  - Nail dystrophy with thickening and discoloration of the nail develops.
• Tinea corporis:
  - The skin lesions have annular scaly plaques with raised edges.
  - There may be vesicles and pustules.
  - Typically lesions are on exposed skin of the trunk, arms and legs (see 'Differential diagnosis', below).
  - More unusually the lesions can appear as overlapping concentric circles (tinea imbricate) or even herpetiform subcorneal vesicles or pustules (bullous tinea corporis).

• Tinea manuum:
  - Usually with tinea pedis.
  - Typically just affects one hand.
  - Scaling and redness are prominent.
  - Incorrect diagnosis and use of steroid may eventually exacerbate the infection.

• Tinea cruris:
  - Usually occurs in men.
  - Often tolerated for some time before presentation.
  - Typically erythematous with central clearing and raised edge.
Tinea barbae: Affects the beard area. Redness, scaling and pustules are common.

Differential diagnosis

Other annular rashes are often confused with tinea infections. Eczema and psoriasis are commonly confused with tinea. Pityriasis versicolor occurs all over the trunk while candida occurs as a flexural rash at extremes of age or in the immunocompromised, those with diabetes or patients on antibiotics.

Treatment with topical steroids often causes confusion, making tinea less scaly and more erythematous. Steroid use also makes the 'active' edge and the inactive centre less distinct (tinea incognito). Clinically the diagnosis can be difficult but, if it is a possibility, take scrapings for mycology. Other fungal infections look nothing like tinea. Other conditions to consider include:

- Contact dermatitis
- Seborrhoeic dermatitis
- Intertrigo
- Erythrasma
- Mycosis fungoides
- Alopecia areata

Investigations

- Microscopy of skin and nail specimens may reveal hyphae and spores.
- Fungal culture can identify the species but is not always reliable and it can take six weeks to obtain results.
- Ultraviolet light (Wood's light) is useful for tinea capitis especially. Fluorescence is produced by the fungus. Fluorescence is not seen with tinea corporis or tinea cruris.
- Rarely, a biopsy may be needed if the case is atypical or not responding to treatment.

Associated diseases

Diabetes, immunocompromised states, atopy and Cushing's syndrome have all been associated with fungal infections.

Management

- For most skin infections it is sufficient to apply an imidazole cream twice-daily. Treatment is continued for 1-2 weeks after the skin has healed. Common antifungals include:
  - Clotrimazole
  - Econazole
  - Ketoconazole
  - Miconazole
- Terbinafine cream daily can be considered as an alternative. Although more expensive, it usually requires only one week of treatment topically compared to at least four weeks with imidazoles. If this fails to clear, re-check mycology - if negative, reconsider diagnosis. It is not licensed for use under the age of 12 years.
- Clotrimazole or miconazole is recommended topically for pregnant or breast-feeding women.
- Other antifungals available are:
  - Griseofulvin (spray).
  - Salicylic acid.
  - Undecenoates.
  - Compound benzoic acid ointment (Whitfield's ointment) - sometimes used for ringworm infections but less cosmetically acceptable than other options.
  - Tolnaftate - often a constituent of athlete's foot treatments, sold over the counter.
Agents containing a corticosteroid are not usually necessary. They may be used if there is a lot of skin inflammation. They should be used for a week only. Topical steroids alone should obviously not be used.

Offer advice on hygiene measures:
- Continue school and sporting activities.
- Cover feet in communal changing areas if these are involved.

Systemic agents are appropriate for tinea capitis\(^7\) and onychomycosis\(^8\) (although topical nail preparations such as amorolfine or tioconazole can be used in limited distal nail disease). Systemic agents should be used for extensive disease. They may also be used when topical treatments have failed or are inappropriate. Skin scrapings should be sent before starting oral treatment:
  - Terbinafine 250 mg daily for two weeks (up to six weeks).
  - Itraconazole 100 mg twice-daily for one week (high dose for one week or low dose for 30 days). Itraconazole can be given in a pulsed fashion and is preferred to terbinafine.

Referral may be needed if diagnosis is in doubt.

Note also:
- Griseofulvin tablets are still available but have been largely superseded by other antifungal agents. It is, however, still the drug of choice in trichophyton infections in children. Terbinafine and itraconazole are not licensed for use in children.\(^{13}\)
- It is worth considering treatment of associated onychomycosis in tinea cruris and tinea pedis to prevent re-infection.\(^8, 8\)
- Consider referral of children to a dermatologist when systemic treatment is contemplated.

Complications

The main complication is secondary bacterial infection. Hair loss is a complication of tinea capitis. Pain and difficulty with shoes can result from onychomycosis.

Prognosis

Excellent with good compliance and subsequent precautions to avoid repeat infection.

Prevention

- Good skin hygiene.
- Good nail hygiene.
- Avoiding prolonged wetting or dampness of the skin and feet.
- Avoiding trainers, which can retain sweat and promote a warm, moist environment.
- Treatment of tinea pedis - helps prevent onychomycosis.\(^8\)
- Wearing clean, loose-fitting underwear.

Further reading & references

4. Dermatophytosis; Mycology Online, 2012 (last modified 2015)
8. Fungal skin infection - foot; NICE CKS, September 2014 (UK access only)
9. Fungal skin infection - scalp; NICE CKS, September 2014 (UK access only)
10. Fungal nail infection; NICE CKS, September 2014 (UK access only)