

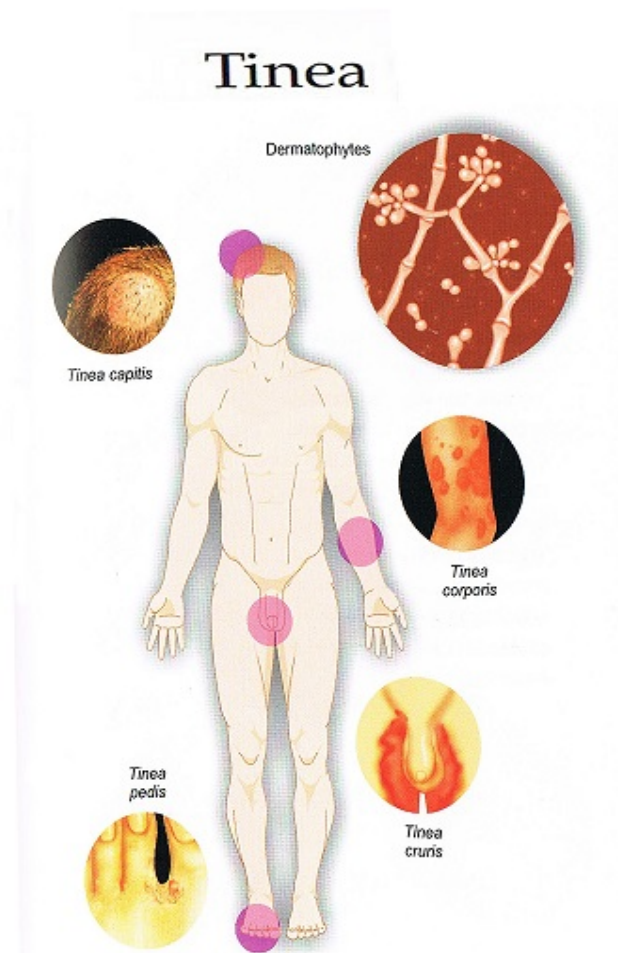
# TINEA (FUNGAL) INFECTION

## Tinea infection

There are 3 main groups of fungal organisms that can cause skin infections. They include dermatophytes, yeast and moulds. Dermatophytes consist of *Tinea corporis*, *pedis*, *cruris*, *capitis*, *barbae*, *manuum* and *Onychomycosis* depending on the sites involved. Dermatophytes infection is also called Tinea (fungal infection) which will be discussed in details below.

Yeasts infection consist of candida infection and *Malassezia* infection like pityriasis versicolor (also known as tinea versicolor). Candida infection also known as candidiasis will be discussed in greater details at an affiliate webpage. Pityriasis Versicolor is discussed in great details below.

Tinea which means fungal skin infection is named according to the parts of the body it infects. The main groups are *Tinea Barbae* (beard), *Tinea Capitis* (Head), *Tinea Corporis* (body), *Tinea Cruris* (genitalia), *Tinea Faciei* (Face), *Tinea Magnum* (Hand), *Tinea Pedis* (Foot), *Tinea Unguium* (Nail) and *Tinea Versicolor* (also known as pityriasis versicolor mainly affect the trunk).



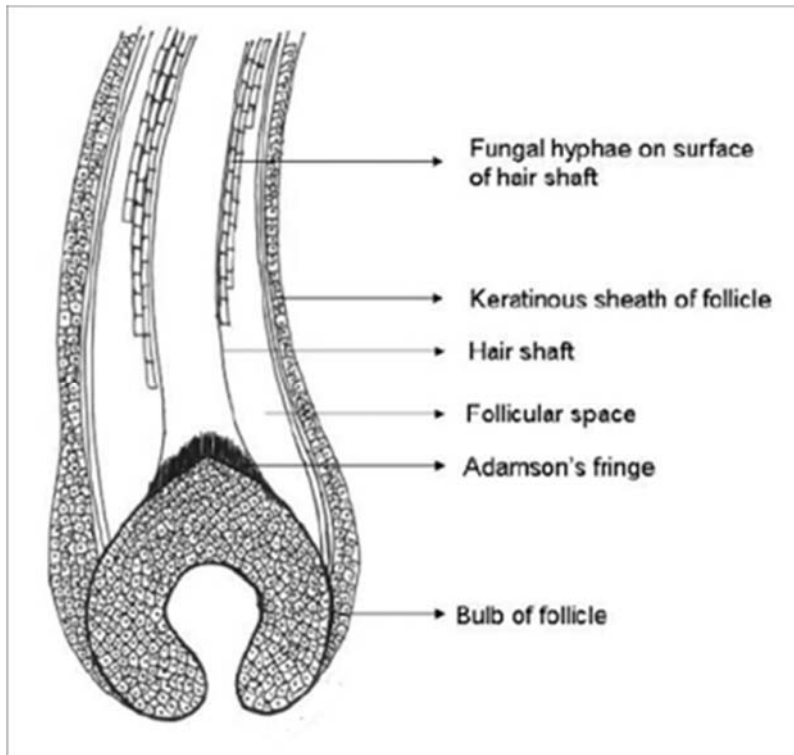
## Tinea Capitis (Head)

Tinea Capitis refer to a dermatophytes (fungal) infection of the scalp, eyebrows and eyelashes caused by *Trichophyton* and *Microsporum* fungi. It is more common in children under 10 years old and peak at those between 3-7 years.

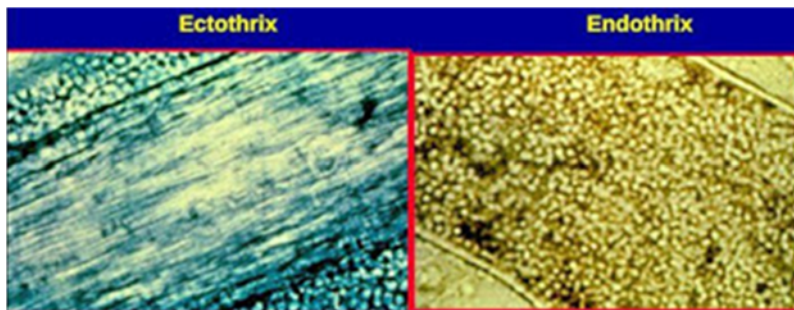
The fungal infection can be classified by how the fungal invade the hair shaft. It can be Ectothrix, Endothrix and Favus infection:



Ectothrix infection is due to infection with *M. canis*, *M. audouinii*, *M. distortum*, *M. ferrugineum*, *M. gypseum*, *M. nanum*, and *T. verrucosum*. The fungal spores (arthroconidia) and branches (hyphae) around the hair shaft or beneath the cuticle of hair. Ectothrix infections can be identified by Woods light (long wave ultraviolet light) examination of the affected. The fur will turn fluoresces green under woods light if infected with *M. canis*.



Endothrix infection is due to infection with *T. tonsurans*, *T. violaceum* and *T. soudanense*. The hair shaft is filled with spores (arthroconidia) and fungal branches (hyphae) during both anagen and telogen phases. Endothrix infections do not turn fluoresce green with Woods light. These infections tend to become chronic and progresses into adulthood.



Favus is caused by *T. schoenleinii* infection which results in a honeycomb-like destruction (crusts and scutula) of the hair shaft and also corresponding hair loss.



Clinical features: Patients may present with red papules initially which then turn into grayish- ring patches. Some may have dry scaling, pustules with yellow crusts or black dot Tinea capitis (fracture of hair shaft leaving infected dark black stubs). Kerions are infected inflammatory abscesses which progress to patchy diffuse hair loss with or without scarring. Alopecia in Tinea capitis will usually be patchy with short broken hairs. Regional cervical lymph nodes will also be swollen and inflamed.



Diagnosis: Diagnosis is confirmed by direct microscopy and culture of the skin scrapings under potassium hydroxide preparation or from hair pulled out by the roots. If diagnosis in doubt, a biopsy can be performed.



FIGURE 4: *Microsporum canis*. Thick-walled fusiform macroconidium containing 11 internal cells and asymmetrical tapering extremities.

Treatment: Treatment is effective with oral antifungals like griseofulvin, terbinafine, Itraconazole and ketoconazole.

Griseofulvin is most effective. Dosage is 10-20mg per kg per day for children for 6-8 weeks and 250mg to 500 mg twice daily 4-6 weeks for adults. Side effects include nausea, headache, photosensitivity, elevated serum liver enzymes, raised triglycerides and uric acid levels, anemia, eosinophilia, leucocytosis and granulocytopenia and aneuploidy. Avoid during pregnancy and 1 month after conception.



Oral Terbinafine can be given at a dose of 5-8 mg/kg/day for 4 weeks.

Topical antifungal application is generally ineffective. Carriers of Tinea infection can use topical antifungal shampoos twice weekly for 4 weeks. The shampoos available are 2.5% selenium sulfide, 2% ketoconazole, povidone-iodine and 1-2% zinc pyrithione.



Tinea Barbae, Corporis, Cruris, Faciei, Manuum & Pedis

Tinea can affect different parts of body mainly: Barbae (beard), Corporis (body), Cruris (genitalia), Faciei (Face), Magnum (Hand) and Pedis (Foot). Like Tinea Capitis (Head) it is caused by dermatophytes Trichophyton, Microsporum, and Epidermophyton.

Clinical features: It can be an acute infection (sudden onset of rash) or chronic infection (extension from pre-existing rash). It usually starts off as red scaly itchy patches which may worsen and enlarge. The central area will heal first resulting in a ring shaped rash hence tinea infection is sometimes called ringworm infection. Maceration and scaling may occur over at the web spaces of feet.



With continuous inflammation, there may be crusting, vesicles, bullae and scaling especially on the outer border. A Kerion is an infected fungal abscess filled with pustules. Majocchi granuloma caused by *T. rubrum*, is a fungal infection involving the hair, hair follicles, and the surrounding dermis resulting in a granulomatous reaction forming pustules and nodules on the skin.



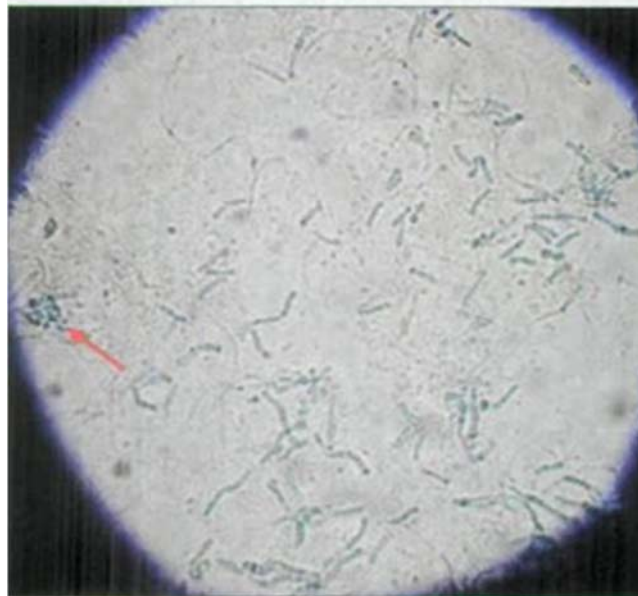
**Majocchi Granuloma**

*Tinea imbricata* is caused by *T. concentricum* and occurs in Southeast Asia, the South Pacific, Central America, and South America. It often presents as brown scaly concentric rings.



Diagnosis: Skin scrapings from suspicious lesions with potassium hydroxide preparation can be examined under direct microscopy to check for fungal. Fungal culture can also be used to confirm diagnosis. If in doubt, a skin biopsy and histological findings will aid in diagnosis.

Microscopic appearance of *Malassezia* fungi. Dead skin cells were obtained by scraping lesions from a patient with tinea versicolor onto a microscope slide and treating the sample with potassium hydroxide. The red arrow indicates fungal spores.





Treatment: Topical antifungal creams should be tried first to treat superficial localized fungal infection. If topical creams fail or if there is a large surface area of skin involved, oral antifungal tablets can be prescribed.



Topical antifungal creams like ketoconazole, clotrimazole and miconazole can be applied to the lesion and 2 cm beyond about once to twice daily for at least 2 weeks. It should be continued for another 1 week after the signs and symptoms have resolved. Antifungal agents inhibit the synthesis of ergosterol which is a major fungal cell membrane sterol. Combination of anti-fungal agent can be combined with steroid (e.g. miconazole with hydrocortisone) to relief inflammation.



Common antifungal drugs include griseofulvin, terbinafine, Itraconazole and fluconazole. Griseofulvin 500-1000mg once daily (10mg/kg/day) for 4-6 weeks or Terbinafine 250 mg once daily for 2-4 weeks can be given till clinical clearance. If patients are started on antifungal, they may experience side effects like headache, nausea, and diarrhea and raised liver enzymes. Liver function test should be monitored.



Oral antibiotics can be prescribed if there is secondary bacterial infection.

### Tinea Unguium (Onychomycosis)

Tinea Unguium refers to fungal infection of the fingernails or toenails. It is also called Onychomycosis. It can be caused by Dermatophytes such as *Trichophyton rubrum* (T rubrum), *T. interdigitale*, Yeasts such as *Candida albicans* and Moulds such as *Scopulariopsis brevicaulis* and *Fusarium* species.

Onychomycosis accounts for half of all nail disorders and is more common in adults. It occurs more commonly in men than women.



Clinical presentation: Onychomycosis usually do not cause symptoms and patients first notice it because of cosmetic reasons. The types of Onychomycosis will present differently.

In distal lateral subungual Onychomycosis, the nail will have subungual hyperkeratosis (thickening of nail plate) and onycholysis (separation of nail plate from the bed). The nail plate is usually yellow-white in color at one side of the nail.



Endonyx Onychomycosis presents with milky white discoloration of the nail plate without thickening or lifting of nail plate.



White superficial Onychomycosis affects only toenails and looks like small white powdery patches on the nail plate. The nail is roughened and crumbles pretty easily.



Proximal subungual Onychomycosis begins with an area of leukonychia (white nail plate) which moves distally as the nail grows.



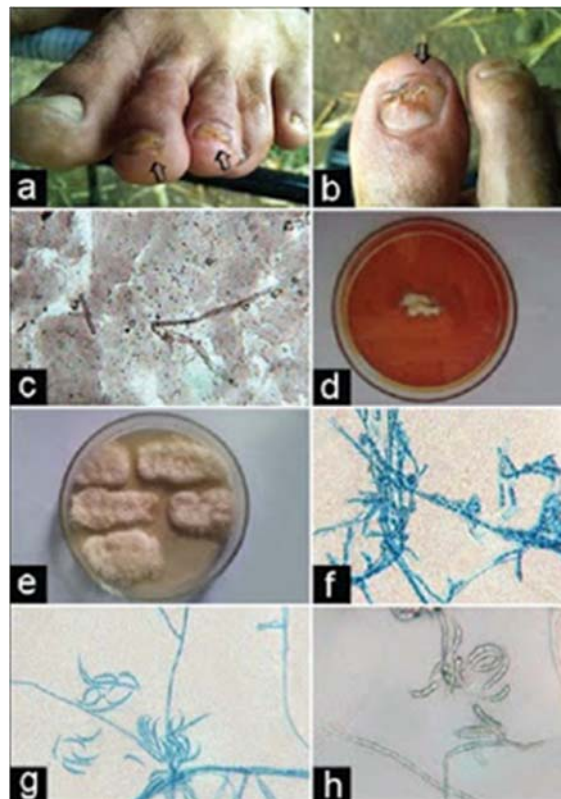
Total dystrophic Onychomycosis results in thickened, opaque, disfigured and yellow-brown nail.



Onychomycosis caused by candida is usually associated with chronic skin candidiasis or immunosuppression. The fingers and nails involved will be swollen and looks like drumsticks with periungual (surrounding the nail) inflammation.



Diagnosis: Onychomycosis may look like other nail disorders hence tests should be done to confirm diagnosis before starting treatment. Nail clippings from affected nails should be examined under direct microscopy and sent for culture for definitive diagnosis. Polymerase chain reaction (PCR) assays can also be used to detect fungal DNA from infected nails. If still in doubt, biopsy will reveal typical histological findings of Onychomycosis.



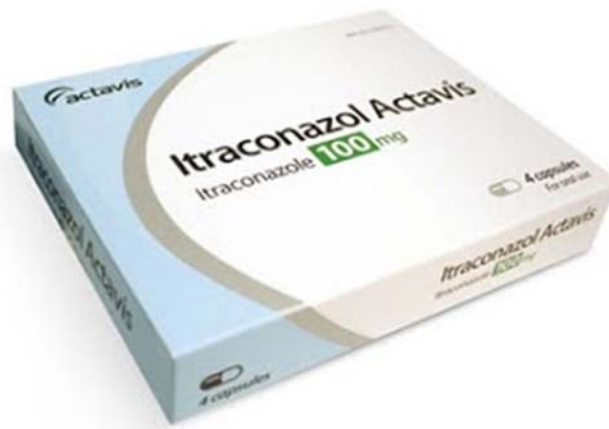
Treatment: fingernails tend to heal more quickly than toenails. In patients with very mild

Onychomycosis which affect only less than 80% of one or two nails may benefit from topical antifungals like amorolfine, ciclopirox olamine 8% nail lacquer solution and bifonazole/urea.



In patients with more extensive Onychomycosis, oral antifungal therapy with Itraconazole and terbinafine for example is treatment of choice. To minimize side effects of antifungal drugs like liver enzymes elevation, headache and gastrointestinal side effects, it may be combined with topical agents. The oral antifungals need to be consumed sometimes up to months for cure.

Oral Terbinafine can be given at 250 mg per day continuously for 12 weeks to treat toenail infections and for six weeks to treat fingernail infections. Oral Itraconazole can be given 200 mg once daily continuously for 12 weeks to treat toenail infections and for six weeks to treat fingernail infections. Liver enzyme monitoring is recommended before continuous therapy is initiated and every four to six weeks during treatment.



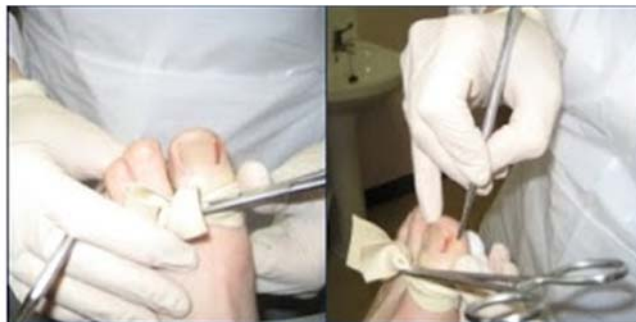
Lasers like Nd:YAG lasers and diode lasers which emits infrared radiation may be able to kill fungi by the production of heat within the infected tissue. However there is no strong evidence suggesting its effectiveness.



Photodynamic therapy: application of 5-aminolevulinic acid or methyl aminolevulinate followed by exposure to red light is found to be successful in some patients in non-controlled studies.



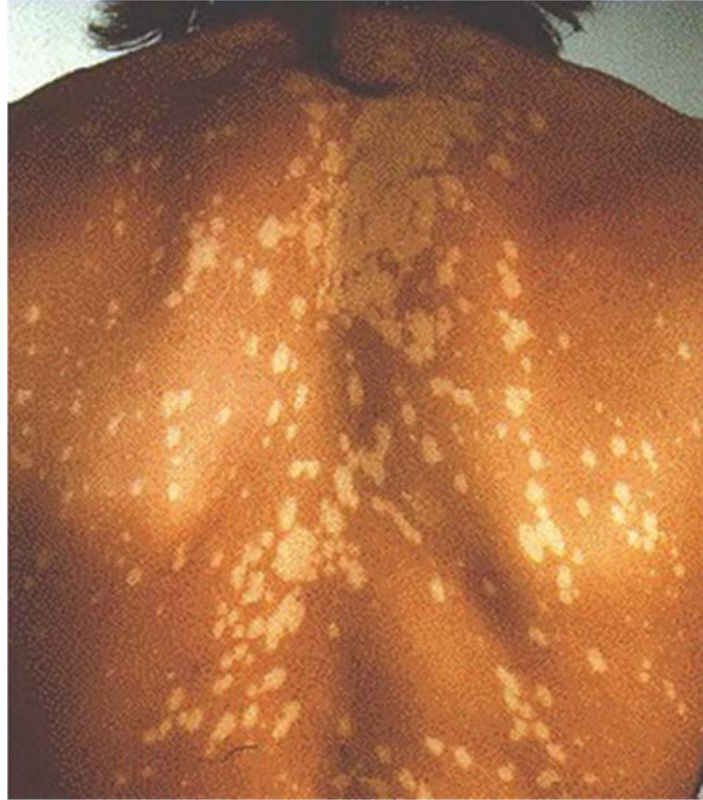
Surgical removal of the nail is also an option in certain patients.



Pityriasis Versicolor



Tinea Versicolor is also known as Pityriasis Versicolor which is a common benign skin condition that often affects the chest and back. Pityriasis means “scaly” and Versicolor means “multiple colors. It is characterized by hypopigmented or hyperpigmented flaky scaly skin patches on the body caused by a fungal infection. It commonly occurs in teenagers and young adults with average onset age of 15-24 years old.

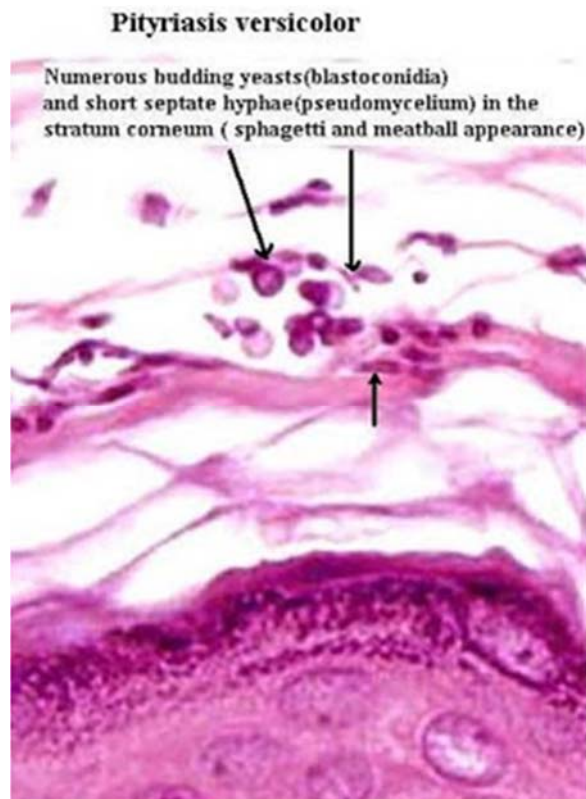


**Causes:** Pityriasis Versicolor is caused by the fungus *Malassezia Furfur*. *Malassezia furfur* can be found on normal healthy skin. When they grow over actively on the skin that's when pityriasis Versicolor forms. Predisposing factors include immunosuppressant states, genetic predisposition, warm humid environments, Cushing disease and malnutrition. As it is caused by the fungus which is normally found on skin so it is not infectious or contagious.

**Clinical features:** The lesions can range from pale color, pink to brown color scaly oval shaped patches. Pale patches are common in darker-skinned people. The lesions are commonly found on the trunk, neck and arms.



Investigations: Pityriasis Versicolor is usually diagnosed clinically. Using Wood's light (long wave ultraviolet) to examine the lesions will reveal yellow-green fluorescence. Diagnosis is often confirmed with potassium hydroxide microscopic examination which will reveal fungal spores with mycelium resembling spaghetti and meatballs picture.



Treatment: It is caused by fungus so treatment involves topical antifungal (azole creams and topical selenium sulfide) or oral antifungal (ketoconazole, Itraconazole and fluconazole). Despite treatment, recurrence can occur.

