

FUNGAL INFECTIONS OF THE SKIN

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GENERAL CONSIDERATIONS

- Fungi are ubiquitous in nature
- Have an organized genetic material enclosed by a rigid wall
- Fungi are divided into: - **moulds** (made of hyphae - grow continuously by branching)
- **yeasts** (made of globular cells reproducing by budding)
- Dimorphic fungi →switch their form depending on the environmental conditions

TERMINOLOGY FOR FUNGI

- **Hyphae** – elongated, filamentous fungi (dermatophytes)
- **Pseudohyphae** – a chain of easily disrupted fungal cells with constrictions
- **Yeast** – round/ovoid, form chains or pseudohyphae
- **Mycelium** – intertwining mass of hyphae
- **Arthrospores** – fungal spores formed by hyphal segmentation
- **Grains** – dense accumulations (microcolonies) of fungi
- **Sporangia** – spherule containing endospores
- **Tinea** – clinical term for superficial fungal infections

Classification of Fungal Infections

- **Primary cutaneous fungal infections** :
 - - superficial cutaneous fungal infections
 - - deep cutaneous fungal infections (implantation mycoses: Sporotrichosis, Chromomycosis, Eumycetoma, Blastomycosis, Lobomycosis, Rhinosporidiasis)
- **Secondary fungal infections** (systemic infections with sec. skin dissemination (disseminated Candidiasis, Aspergillosis, Cryptococcosis, Histoplasmosis, Zygomycosis)
- **Opportunistic infections**: primary or sec. skin lesions in immunocompromised individuals

CONFIRMATION OF DIAGNOSIS

- Skin scrapings
- Nail clippings
- Hair plucking
- Specimen collection in sufficient amount, in sterile glass containers
- Specimens are mounted in 20% KOH for direct microscopy
- Incubation for 4 - 6 wks. in Sabouraud's medium with Chloramphenicol to inhibit bacterial contamination

SPECIAL STAINS FOR FUNGI

- PAS stain → colours fungi in red
- GMS (Gomori methenamine silver nitrate)→stains fungi in black
- Mucicarmine, Alcian blue, India ink → highlights mucopolisaccharides in the fungal walls

IMMUNE RESPONSE TO FUNGI

- As with bacteria, fungal flora on the surface of the skin of healthy persons, consists of 2 populations:
 - **transient colonization** (temporary contamination of perineum from GIT or vagina)
 - **resident commensals** : Pityrosporum spp. Clustered around the openings of sebaceous glands)
- CMI actively eliminates dermatophytes from skin
- Non specific defence mechanisms prevent invasion into the dermis and blood stream
- The fungus secretes enzymes (keratinases) that allow it to burrow deep into Stratum corneum

SUPERFICIAL MYCOSES

- Fungi that only invade fully keratinized tissues (horny layer, hair, nails)
- Further subdivided into:
 - a. **Minimal inflammation**: Pityriasis (tinea) Versicolor—P.Ovale
Tinea Nigra –Exophiala Werneckii
 - b. **Variable degree of inflammation**:
 - Dermatophytes : Trichophyton, Microsporum, Epidermophyton
 - Candida spp.
- 3 genera : 1. Trichophyton – isolated from skin, hair, nails
2. Microsporum: infected hairs+ epidermis
3. Epidermophyton: only from infected epidermis

TRANSMISSION

- Infection acquired by contact with keratin debris carrying the fungal hyphae
- **Man-to-man transmission (anthropophilic)**: T. Rubrum, T. Tonsurans, T. Mentagrophites, E.Floccosum
- **Animal-to-man transmission (zoophilic)**: M.canis, M.nanum, T. mentagrophites, T. Veruccosum
- **Soil-to-man (geophilic)**: M. ferrugineum, M.gypseum, M.fulvum

TINEA CAPITIS

- TC is a dermatophytic infection of the scalp hair follicles and intervening skin
- Most common dermatophytosis in prepubertal children aged 3 to 7 years
- No predilection of gender
- Main aetiological agents of TC in Africa: T.violaceum, T. sudanense, M. canis, M. pherugineum, M. aydounii
- Change in the pattern of infectious agents
- Poor personal hygiene, crowded living conditions, low socio-economic status

CLINICAL FORMS OF TINEA CAPITIS

- Tinea capitis superficialis (non-inflammatory)
- Tinea capitis profundum→ inflammatory form: kerion & agminate folliculitis
- Tinea capitis favosa (Favus)
- Atypical forms and TC Incognita

CLINICAL APPEARANCES OF T.CAPITIS

- Diffuse scale with/without erythema; no hair loss
- Moth-eaten → patchy hair loss ; scaly scalp
- Gray patch → marked scaly patch, broken hairs
- Black dot → swollen stubs of broken hairs; patchy alopecia
- Agminate folliculitis: widespread scattered pustules
- Kerion Celsi: boggy nodules, discharging sinuses, alopecia, lymphadenopathy
- Favus: honey-colored, cup-shaped, follicular crusts & alopecia

PATHOGENESIS OF TINEA CAPITIS

- TC is mainly caused by anthropophilic & zoophilic spp. of the genera *Trichophyton* and *Microsporum*
- On basis of the type of hair invasion, dermatophytes are also classified as: endothrix, ectothrix, favus
- **Endothrix infection**: fungus grows completely within the hair shaft, hyphae are converted into spores within the hair while the cuticle of the hair remains intact
- **Ectothrix infection**: the hyphae destroy the hair cuticle and grow around the hair shaft
- **Favus**: production of hyphae which are parallel to long axis of the hair shaft

ASYMPTOMATIC DERMATOPHYTE SCALP CARRIAGE

- A person without signs or symptoms of TC but with dermatophyte – positive scalp culture
- Asymptomatic carriage is organism specific
- Anthropophilic dermatophytes → associated with high rates of asymptomatic carriage (mild inflammation)
- Zoophilic dermatophytes are less likely to lead to an asymptomatic carrier state (they produce overt infection)
- Asymptomatic carriers at home/school → sources of disease transmission

LABORATORY DIAGNOSIS

- KOH 20%-30% **direct microscopy**
- **Culture**: Sabouraud's Glucose Agar medium with Chloramphenicol + Cycloheximide
- Numerous methods for rapid nucleic acid-based distinction of dermatophytes described → Not routinely performed (**PCR**)
- **Dermoscopy**: comma shape hairs
- **Wood's light examination** → Ectothrix dermatophytes cause the hair to fluoresce bright green (useful Dx. aid)
→ Endothrix dermatophytes do not fluoresce at all (limited screening + monitoring of TC)

DIFFERENTIAL DIAGNOSIS

- Seborrheic Dermatitis or Atopic dermatitis
- Psoriasis
- Tinea Amiantacea
- Trichotillomania
- Bacterial infections of the scalp
- Alopecia Areata
- Tufted hair folliculitis
- Langerhans cell histiocytosis

COMPLICATIONS OF TINEA CAPITIS

- Lymphadenitis
- Bacterial Pyoderma
- Pigmenting Pityriasis Alba
- Id reaction (after the initiation of the drug therapy)
- Secondary bacterial infections
- Scarring alopecia

TREATMENT

- Tinea Capitis always requires systemic TX.
- Topical Tx. is only used as adjuvant therapy to systemic antifungals
- Tx → adjusted to the clinical type of TC (superf/deep, endo- or ectothrix?)
- Mycological culture is essential
- Age and weight of patient
- Family members, environment (school, rural areas, pet-puppies, kittens, dwarfish rabbit)

TREATMENT (Ctd)

- Griseofulvin → gold standard for systemic Tx of TC
 - active against dermatophytes
 - long-term safety profile
 - efficacy comparable to newer azoles
 - cheaper
- Duration of Tx : 8-12 weeks
- Dose : 20-25 mg/kg/day
- Mycological cure & efficacy rates are high (80%-96%)
- Contraindicated in : Porphyria, SLE, liver disease
- Drug interactions: warfarin, phenobarbital, CyA

TREATMENT (Ctd.)

- Ketoconazole shampoo weekly—patient, family, school mates
- Control pet-farm animals
- Clinical and mycological control every 2 weeks
- Stop Tx after mycological cure
- **Terbinafine** : 10-20 kg→ 62.5mg (1/4 tab) per day
20-40 kg→125mg (1/2 tab) per day
> 40 kg→ 250 mg 1 tab) per day
- 2 – 4 week duration of Tx

TREATMENT (Ctd.)

- **Itraconazole**: caps + oral sol.
- Antifungal triazole against Trichophyton & Microsporum spp.
- Dose : 5 mg/kg/day
- Duration of treatment: 4-6 weeks with cure rates :85.7% to 88%
- Pulse regimen: one pulse of 5mg/kg/day for 1wk with 3 wks off
- Side effects: headache, GIT symptoms, rash, liver abnormalities
- **Fluconazole** : fungistatic triazole, high oral bioavailability
- Doses: 5-6mg/kg/day for 3-6 weeks
- Alternative regimen: once weekly 8mg/kg pulse dosing for 8-12 weeks
- Side effects: haematologic and hepatic toxicity

TOPICAL TREATMENT

- Adjunctive topical TX with Selenium sulphide & Ketoconazole shampoos (2-3 X weekly for 4 weeks)
- Fungicidal creams/lotions once daily
- **Additional measures**: keeping the children out of school ?
 - patient education (not to share personal items such as: combs, hair brushes, scarves, hats)
 - sports with prolonged close contact (rugby, wrestling)—prohibited
 - school authorities should be notified
- Steroids/ Antibiotics/ Antihistamines
- Incision of kerion nodules—Not recommended

TINEA CORPORIS (Tinea Circinata)

- Affects the glabrous skin: T. faciae, T. cruris, T. manus, T. pedis, T. corporis
- T. rubrum, T. mentagrophytes, M. Canis
- Common in children and immunocompromised adults
- Clinical polymorphism (tropics) and atypical forms
- Annular, red active raised border with scaly edge
- Solitary / multiple lesions
- TX: oral Griseofulvin for 3-4 weeks ; alternatively Terbinafine, Itraconazole for 2-to-3 weeks
- Topicals: Clotrimazole, ketoconazole, miconazole

TINEA CORPORIS (Ctd.)

- **Majocchi's granuloma** (nodular granulomatous perifolliculitis)→T. Rubrum; less others
 - lower leg in young women
 - increased association with T. pedis/ onychomycosis
 - physical trauma (broken hair keratin & debris+fungus introduced into the dermis)
- **Tinea Incognito** : fungal infection whose appearance has been changed by excessive and prolonged use of topical steroids
- **Id reaction**→acute, florid vesicular type of T. pedis induces an acute vesiculo-bullous eruption on hands (reactive process of unknown pathomechanism, presumably immunologic)

TINEA CRURIS (axillary, submammary)

- Predisposing factors: perspiration, friction in flexures
- *T. rubrum*, *E. floccosum* (Africa), *T. mentagrophytes*
- Groins & perineum—common in men, rare in women
- Well demarcated, large erythematous, scaly patches with raised, active borders
- Lesions extend to pubic area, intergluteal fold/buttock
- Usually in men with tinea pedis (check the foot)
- Chronic course, relapses
- Ddx. → Seborrheic dermatitis, Inverse Psoriasis, Intertrigo

TINEA PEDIS

- The most common dermatophytic infection
- Mainly seen in adolescents and adults
- Fungi live in macerated skin in web spaces of toes (*T. mentagrophytes*, *T. rubrum*, *E. floccosum*)
- Spreads by contact (infected keratin debris on the floors, swimming pools, showers, carpets)
- Four clinical variants:
 - Interdigital type (+bacterial infection)
 - Moccasin, squamous type (chr.)
 - Inflammatory vesicular type
 - Ulcerative type
- Tx: Syst. Antifungals for 3wks./ top.antifungals/syst.Antibiotics

TINEA UNGUIUM

- Common in adults
- Thickened nail plates (subungual hyperkeratosis), opaque, friable, dischromia
- Associated with *T. pedis*
- Important Ddx. → Psoriasis
- Tx.
 - Griseofulvin po. 500mg-1g/day for 12-16 months
 - Terbinafine (Lamisil) po 250mg/day for 4-6 months
 - Itraconazole (Sporanox) 100mg/day for 3/12 + pulses for 6/12
 - Loceryl laq. weekly painting of the nails

FAVUS (Honeycomb ring worm)

- Tropical superficial fungal infection
- *Trichophyton Schoenleinii*
- Affects the scalp (scutula+cicatriceal alopecia, mousy odor)
- Distribution: Mediterranean basin, Middle East, South Africa
- Prepubertal boys
- Clinically: red, scaly patches → scutula around the hairs → coalesce into a thick crust
- No tendency to spontaneous healing
- Moderately contagious (seldom epidemic)
- General health is not affected
- Tx: Griseofulvin for 6 weeks

CANDIDIASIS (MONILIASIS)

- Infection of the skin + mucous membranes + nails
- *Candida albicans* (yeast; dimorphic fungus showing polymorphism: budding cells, hyphae, pseudohyphae)
- Normal commensal in the mouth, GIT, vagina
- Is not a regular member of the cutaneous microflora (does not colonize intact dry skin)
- *Candida* is the most common pathogen in solid organ transplant recipients

CANDIDIASIS (Ctd.)

- Factors predisposing to pathogenicity:
 - **Systemic** - endocrine: DM, pregnancy, OCP, AB, CS, cytotoxic
 - immunosuppression (congenital or acquired)
 - malnutrition
 - debilitating diseases (very ill)
 - very young (infants) + very old
 - **Local** - moisture, warmth, maceration
 - local tissue damage: ulceration, IUD, false denture
 - eczematous skin (seborrheic dermatitis)

CLINICAL TYPES OF CANDIDIASIS

- Superficial candidiasis mainly affects the sites of carriage of organism (periorificial)
- **Mucosal Candidiasis**: oral thrush, angular cheilitis, glossitis
 - vaginal candidiasis (vulvovaginitis)
 - balanitis
- Infection of the skin surface (less common)
- **Candida intertrigo** (axillae, groins, submammary folds)→
 - obesity, poor hygiene, perspiration
- **Candidal paronychia**: chronic inflammation of proximal nail fold/nail matrix by *C. Albicans* + bacteria resulting in swollen red nail folds, whitish pus, nail dystrophy

TREATMENT

- **Topical**: Nystatin (specific for *Candida* only)
 - Imidazoles (clotrimazole, econazole, miconazole)
 - Amphotericin B (Fungizone) lozenges for mouth inf.
- **Systemic**: Nystatin – oral only for GIT infection
 - Itraconazole (Sporanox)- absorbed from the gut
 - Amphotericin B – IV in immunocompromised Pts.
 - Fluconazole (Diflucan) – oral or IV
- **Chronic Mucocutaneous Candidiasis**—rare, chronic immunodeficiency disorder: persistent and recurrent candida infections of the skin, nails, mucosa associated in 50% cases with endocrine disease (hypothyroidism, diabetes mellitus)

PITYRIASIS VERSICOLOR

- Common condition in young adults
- Lipophilic yeast: *Pityrosporum ovale*/ *P. Orbiculare*
- Normal skin commensals in pilo-sebaceous units
- Present on the skin from infancy- children- peak in teens
- Asymptomatic/ slightly pruritic
- Café-au-lait macules, scaly, on trunk ,arms (Whites)
- Hypo-pigmented patches in dark skin
- Tx : Selenium sulphide shampoo (Selsun 2.5%)
 - 20% Sodium thiosulphate sol.
 - Top. Imidazoles (Econazole)
 - Itraconazole – orally for 7 days (100mg/day)
 - Ketoconazole – orally for 14 days

PITYRIASIS AMIANTACEA

- A reaction of the scalp without evident cause
- May complicate: Seborrheic dermatitis, Psoriasis, Lichen simplex
- Occur at any age (5-40yr) mean age 25 yrs
- Clinically: masses of adherent, silvery scales, attached to the scalp which is red and scaly
- Young girls: recurrent or chronic fissures behind the ears with scales at the distance on the scalp
- Usually it has a limited distribution on the scalp (it may extend involving large areas)
- Certain degree of hair loss in areas of scaling (sec. alopecia)
- Tx: remove the abundant scales using top. Tar/SA oint.
 - wash out the scalp after 4 hrs. with NIZ shampoo or LPC
 - potent top. CS sol/ lotion

DEEP FUNGAL INFECTIONS

- Subcutaneous Mycoses or Mycoses of implantation
- Sporotrichosis (*Sporothrix schenckii*) →both Cutaneous & Systemic forms (lymphangitis following the implantation of spores in a wound)
- **Mycetoma** (Madura foot)→ *Madurella mycetomatis* → swelling, draining sinuses and grains in the exudate
- **Chromomycosis** (*Phialophora verrucosa*, *Fonseca pedrosoi*, *Fonseca dermatitidis*, *Cladospirium carrionii*)→ warty lesions
- **Lobomycosis** (keloidal blastomycosis= Lobo disease)
- Subcutaneous **Zygomycosis**
- **Blastomycosis**→ rare in South Africa (skin nodules, abscesses, sinuses, ulcers, slowly progressive ; may disseminate→ lungs, bones)

DEEP/SUBCUTANEOUS MYCOSES

- Caused by fungi isolated from decaying wood and soil by trauma
- Long incubation period (several months)
- Distribution of lesions → exposed sides : feet, legs, hands, face
 - satellite lesions produced by scratching
- Painless (unless sec. infection occurs)
- **Diagnosis** → Culture of samples: skin Bx , pus, exudates , KOH mount of surface crust
- Treatment : Itraconazole (Sporanox)
 - Terbinafine (Lamisil)
 - Flucytosine (alone/ in combination with Sporanox)
 - Amphotericin B (Fungizone) loz. 10mg 4X/day