Fungal infections
Natural defence against fungi

- Fatty acid content of the skin
- pH of the skin, mucosal surfaces and body fluids
- Epidermal turnover
- Normal flora
Predisposing factors

- Tropical climate
- Manual labour population
- Low socioeconomic status
- Profuse sweating
- Friction with clothes, synthetic innerwear
- Malnourishment
- Immunosuppressed patients
  - HIV, Congenital Immunodeficiencies, patients on corticosteroids, immunosuppressive drugs, Diabetes
Fungal infections: Classification

- **Superficial cutaneous:**

- **Subcutaneous:**
  - Mycetoma, Chromoblastomycosis, Sporotrichosis

- **Systemic:** (opportunistic infection)
  - Histoplasmosis, Candidiasis

Of these categories, Dermatophytosis, *P. versicolor*, Candidiasis are common in daily practice.
Pityriasis versicolor

- Etiologic agent: *Malassezia furfur*

Clinical features:

- Common among youth
- Genetic predisposition, familial occurrence
- Multiple, discrete, discoloured, macules.
- Fawn, brown, grey or hypopigmented
- Pinhead sized to large sheets of discolouration
- Seborrheic areas, upper half of body: trunk, arms, neck, abdomen.
- Scratch sign positive
PITYRIASIS VERSICOLOR
P. versicolor: Investigations

- Wood’s Lamp examination:
- Yellow fluorescence
- KOH preparation:

Spaghetti and meatball appearance
Coarse mycelium, fragmented to short filaments 2-5 micron wide and up to 2-5 micron long, together with spherical, thick-walled yeasts 2-8 micron in diameter, arranged in grape-like fashion.
P. versicolor: Differential diagnosis

- Vitiligo
- Pityriasis rosea
- Secondary syphilis
- Seborrhoeic dermatitis
- Erythrasma
- Melasma
Treatment P. versicolor

Topical:
- Ketoconazole, Clotrimazole, Miconazole, Bifonazole, Oxiconazole, Butenafine, Terbinafine, Selenium sulfide, Sodium thiosulphate

Oral:
- Fluconazole 400mg single dose
- Ketoconazole 200mg OD x 14 days
- Griseofulvin is NOT effective.
- Hypopigmentation will take weeks to fade
- Scaling will disappear soon
Treatment P. versicolor

- P. versicolor recurs if predisposing factors not taken care of
- Minimising sweat, frequent washes and control of immunosuppression causes long remission
Pityrosporum folliculitis

- **Etiology:** *Malassezia furfur*
- **Age group:** Teenagers or young adult males
- **Clinical features:** Itchy papules and pustules, scattered on the shoulders and back.
- **Treatment:** Oral Itraconazole, Ketoconazole, Fluconazole or topical Ketoconazole shampoo.
Tinea nigra palmaris

- **Etiology:** *Exophiala werneckii*

- **Clinical features:** Asymptomatic superficial infection of palms; deeply pigmented, brown or black macular, non-scaly patches, resembling a silver nitrate stain.

- **Treatment:** Topical Econazole, Ketoconazole, Benzoic acid compound, Thiabendazole 2% in 90% DMSO or 10% Thiabendazole suspension.
Black piedra

- **Etiology:** *Piedraia hortae*
- **Distribution:** America and in South-East Asia
- **Clinical features:** Hard, dark, multiple superficial nodules; firmly adherent black, gritty, hard nodules on hairs of scalp, beard, moustache or pubic area, hair may fracture easily.
- **Treatment:**
  - Shaving or cutting the hair.
  - Terbinafine, Benzoic acid compound ointment, 1:2000 solution of mercury perchloride
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White piedra

- **Etiology:** *Trichosporon beigeli*
- **Clinical features:**
  - Soft, white, grey or brown superficial nodules on hairs of the beard, moustache, pubic areas, eye brows, eye lashes.
  - Hair shaft weakened and breaks.
- **Treatment:** Shaving or cutting the hair.
  - Responses to topical antifungals, azoles and allyamines have been reported but are unpredictable.
Dermatophytosis

Mycology:

- Three genera: Microsporum, Trichophyton, Epidermophyton.
- They can be zoophilic, anthropophilic or geophilic.
- Thrive on dead, keratinized tissue - within the stratum corneum of the epidermis, within and around the fully keratinized hair shaft, and in the nail plate and keratinized nail bed.

Predisposition:

Poor hygiene, malnutrition, immunosuppressive state, diabetes and Cushing's syndrome.
Dermatophytes are keratinophillic

- The topmost layer is a sheet of dead cells containing a protein – called keratin – stuck together forming a tough barrier
- This barrier, when dry allows fungi to stay on the surface but stops them from piercing it
- This barrier when moist becomes porous and sucks in the fungi like a sponge.
Dermatophytosis (Ringworm)

- **Terminology:**
  - Head: Tinea capitis
  - Face: Tinea faciei
  - Beard: Tinea barbae
  - Trunk/body: Tinea corporis
  - Groin/gluteal folds: Tinea cruris
  - Palms: Tinea manuum
  - Soles: Tinea pedis
  - Nail: Tinea unguium
**Tinea capitis**

Invasion of hair shaft by a dermatophyte fungus.

**Clinical features:**

- Common in children with poor nutrition and hygiene. Rare after puberty because sebum is fungistatic.
- Wide spectrum of lesions - a few dull-grey, broken-off hairs, a little scaling to a severe, painful, inflammatory mass covering the scalp.
- Partial hair loss is common in all types
Tinea capitis

Endothrix and Ectothrix
Term used to indicate infection of hair shaft, spores lying inside or outside hair shaft.

4 varieties:
Gray patch
Black dot
Favus
Kerion similar to a ‘boil’
Non inflammatory Tinea capitis: Black dot/ Grey patch

- Breakage of hair gives rise to ‘black dots’
- Patchy alopecia, often circular, numerous broken-off hairs, dull grey
- Inflammation is minimal
- Wood's lamp examination: green fluorescence (occasional non-fluorescent cases)
Tinea capitis: Kerion

- Inflammatory variety
- Painful, inflammatory boggy swelling with vesicles and pustules.
- Hairs may be matted, easily pluckable
- Lymphadenopathy
- Co-infection with bacteria is common
- May heal with scarring alopecia
Tinea capitis: Favus

- Inflammatory variety
- Yellowish, cup-shaped crusts develop around a hair with the hair projecting centrally. Adjacent crusts enlarge to become confluent mass of yellow crusting.
- Hair may be matted
- Extensive patchy hair loss with cicatricial alopecia
Tinea faciei

- Erythematous scaly patches on the face
- Annular or circinate lesions and induration
- Itching, burning and exacerbation after sun exposure
- Seen often in immunocompromised adults
T. FACEI

T. BARBAE
**Tinea barbae**

- Ringworm of the beard and moustache areas
- Invasion of coarse hairs
- Disease of the adult male
- Highly inflammatory, pustular folliculitis
- Hairs of the beard or moustache are surrounded by inflammatory papulopustules, usually with oozing or crusting, easily pluckable
- Persist several months
Tinea corporis

- Lesions of the trunk and limbs, excluding ringworm of the specialized sites such as the scalp, feet and groins etc.
- The fungus enters the stratum corneum and spreads centrifugally. Central clearing results once the fungi are eliminated.
- A second wave of centrifugal spread from the original site may occur with the formation of concentric erythematous inflammatory rings.
Tinea corporis
Tinea corporis

Classical lesion:

- Annular patch or plaque with erythematous papulovesicles and scaling at the periphery with central clearing resembling the effects of ring worm.
- Polycyclic appearance in advanced infection due to incomplete fusion of multiple lesions
- Sites: waist, under breasts, abdomen, thighs etc.
Differential diagnosis of Tinea corporis

- Psoriasis
- Bullous Impetigo
- Lichen Simplex Chronicus
- Nummular eczema
- Pityriasis Rosea
- Candidiasis
- Secondary syphilis
- Pityriasis versicolor
- Annular lesions of leprosy
Tinea cruris

- Itching
- Erythematous plaques, curved with well demarcated margins extending from the groin down the thighs.
Tinea mannum

Two varieties:

- Non inflammatory: Dry, scaly, mildly itchy
- Inflammatory: Vesicular, itchy
Tinea pedis

- Wearing of shoes and the resultant maceration
- Adult males commonest, children rarely
- Peeling, maceration and fissuring affecting the lateral toe clefts, and sometimes spreading to involve the undersurface of the toes.

Two varieties:

- Dry, scaly, mildly itchy, extensively involved ('moccasin foot')
- Vesicular, itchy, with inflammatory reactions affecting all parts of the feet
T.PEDIS
Tinea pedis: Prevention

- Keeping toes dry
- Not walking barefoot on the floors of communal changing rooms
- Avoiding swimming baths.
- Avoid closed shoes
- Avoid nylon socks
- Use of antifungal powders
Tinea Unguium

Dirty, dull, dry, pitted, ridged, split, discoloured, thick, uneven, nails with subungual hyperkeratosis
Different types described depending on the site of nail involvement and its depth.

- Distal and lateral onychomycoses
- Proximal subungual onychomycoses
- White superficial onychomycoses
- Total dystrophic onychomycoses
Tinea Unguicium  Paronychia
Treatment:

- Topical: Bifonazole, Ketoconazole Oxiconazole, Clotrimazole, Miconazole, Butenafine, Terbinafine.
- Vehicle: Lotions, creams, powders, gels are available.
Treatment: Tinea

- **Oral:** Griseofulvin 250 mg OD
  - Fluconazole 150 mg weekly
  - Ketoconazole 200 mg OD
  - Terbinafine 250 mg OD
  - Itraconazole 200 mg OD
- **Duration:**
  - T.capitis - 6 weeks
  - T.faciei - 4 weeks
  - T.cruris - 2-4 weeks
  - T.corporis - 4-6 weeks
  - T.manuum/pedis - 6-8 weeks

  Shorter duration required for terbinafine & itraconazole
Treatment: Tinea unguium

- The same line of Treatment should be contd for 3 months (fingernail) to 6 months (toenails)
- 8% Ciclopirox olamine lotions for local application
- Amorolfine lacquer painted weekly
- Pulse Therapy
  Terbinafine: 250mg given 1BD 1week / per month
  Itraconazole: 200mg given 1BD 1week/month
  3 pulses for fingernails, 4 pulses for toenails.
Pulse Therapy

- Terbinafine: 250 mg bd given 1 week per month
- Itraconazole: 200 mg bd given 1 week per month
- 3 pulses for finger nails, 4 pulses for toenails
Treatment Principles

- Patient should be explained clearly about the predisposing factors
- Need for personal hygiene, proper clothing should be emphasized

Selection of topical medication:
- Do not use ointments on areas of friction or on greasy areas
- Do not rub creams/ointments in groin folds
- Choose steroid combinations only if itch is a major complaint. Do not use antifungal creams in combination with potent steroids
Treatment  Principles

- Dermatophytosis will take 3-4 weeks to resolve and patient should be told about the need for complete treatment. Treat 1 week beyond apparent cure.
- Need for hygiene, proper clothing.

- Onychomycosis requires 3-6 months of treatment. Treat 4 weeks beyond apparent cure.

- Temporary relief should not be mistaken for cure
Candidiasis

- **Causative organism:**
  
  *Candida albicans, Candida tropicalis, Candida pseudotropicalis*

- **Sites of affection:**
  
  Mucous membrane
  Skin
  Nails
Candidiasis: Mucosal

- Oral thrush:
  Creamy, curd-like, white pseudomembrane, on erythematous base
- Sites:
  Immunocompetent patient: cheeks, gums or the palate.
  Immunocompromised patients: affection of tongue with extension to pharynx or oesophagus; ulcerative lesions may occur.
- Angular cheilitis (angular stomatitis / perleche): Soreness at the angles of the mouth
ORAL THRUSH

PERLECHE
Candidiasis: Mucosal

- **Vulvovaginitis (vulvovaginal thrush):** Itching and soreness with a thick, creamy white discharge
- **Balanoposthitis:**
  Tiny papules on the glans penis after intercourse, evolve as white pustules or vesicles and rupture. Radial fissures on glans penis in diabetics. Vulvovaginitis in conjugal partner
Candidiasis - Flexural

- **Intertrigo**: (Flexural candidiasis): Erythema and maceration in the folds; axilla, groins and webspaces.

- **Napkin rash**: Pustules, with an irregular border and satellite lesions
Candidiasis: Nail

- **Chronic Paronychia:**
  Swelling of the nail fold with pain and discharge of pus.
  Chronic, recurrent.
  Superadded bacterial infection

- **Onychomycosis:**
  Destruction of nail plate.
Candidiasis - Nail

- **Chronic Paronychia:**
  Swelling of the nail fold with pain and discharge of pus.
  Chronic, recurrent.
  Superadded bacterial infection
- **Onychomycosis:**
  Destruction of nail plate
Treatment of candidiasis

- Treat predisposing factors like poor hygiene, diabetes, AIDS, conjugal infection
- **Topical:**
  
  Clotrimazole, Miconazole, Ketoconazole, Ciclopirox olamine

- **Oral:**
  
  Ketoconazole 200mg, Itraconazole 100-200mg and Fluconazole 150mg
Subcutaneous infections

Sporotrichosis

- An acute or chronic fungal infection caused by *Sporothrix schenckii*
- **Clinical features:** Localised lymphatic variety; a chancre, ulcerated nodules in a linear arrangement along the lymphatics. Uncommon: acneiform, nodular, verrucous lesions.
- Hematogenous spread leads to systemic infection in lungs, muscles, bones, CNS.
- **Treatment:** Potassium iodide, IV Amphotericin B, IV Miconazole / Ketoconazole, oral Itraconazole
Mycetoma

Clinical features:

- Triad of tumefaction, sinuses and grains.
- Chronic granulomatous swelling predominantly of feet with discharge of grains of varying shades.
- Colour, consistency and feel of the granules help to differentiate the cause. Blackish brown grains suggest fungal etiology.
- The foot is usually deformed and secondary infection by bacteria may occur.
**Mycetoma**

**Eumycotic**
- *Madurella mycetomatis*
- *Madurella grisea*
- *Acremonium spp*
- *Exophiala jeanselmei*

**Actinomycetoma**
- *Streptomyces somaliensis*
- *Actinomadura pelletieri*
- *Actinomadura madurae*
- *Nocardia asteroides*
- *Nocardia brasiliensis*
Mycetoma

Actinomycotic
- Rapid invasive
- Early presentation
- Pus present
- Granules yellowish white
- Less deformity
- Granules < 1 micron lie singly
- Gram stain + ve
- GMS, PAS - ve
- Responds to antibiotics (Sulphonamides, doxyclines)

Eumycotic Mycetoma
- slowly invasive
- late presentation, being asymptomatic
- no pus
- black brown granules
- more deformity
- 4-5 micron, in clusters
- Gram -ve
- GMS, PAS +ve
- Responds to antifungals (Itraconazole, Amphotericin B)
MYCETOMA
Chromoblastomycosis

- A chronic fungal infection of skin and subcutaneous tissue

- **Organisms:**

  *Phialophora verrucosa*, *P. pedrosoi*, *P. compactum*, *Wangiella dermatitidis*, *Cladosporium carrionii*

- **Clinical Features:**

  Warty papule enlarges to plaque; commonly on feet, legs, neck, face

- **Treatment:**

  Surgical excision, cryotherapy, amphotericin B, Itraconazole
Lobomycosis

- **Organism:** *Loboa loboi*
- **Clinical features:**
  Resembles keloid, can be differentiated by the ability to insinuate finger below the lesion.
  On exposed parts, legs, arms and face may resemble chromoblastomycosis.
- **Treatment:**
  Surgical excision; no effective medical therapy
Rhinosporidiosis

- Chronic granulomatous mycosis caused by *Rhinosporidium seeberi*, inducing polyps of the mucous membrane

- **Clinical features:**
  - Morphology: Lobulated and cauliflower-like polyps that may be pedunculated
  - Sites: mucosal surface - nose, nasopharynx or soft palate; also on larynx, penis, vagina, rectum and sometimes skin.

- **Diagnosis:** Histopathology

- **Treatment:** Excision
Subcutaneous zygomycosis (Entomophthoromycosis)

- Localized subcutaneous and predominantly tropical mycosis caused by *Basidiobolus ranarum*.

- **Clinical features:**
  - Chronic, woody swelling of subcutaneous tissue, slowly spreading; solitary or multiple.

**Diagnosis:**
Histological and mycological examinations

**Treatment:**
Potassium iodide, cotrimoxazole, itraconazole
Systemic infections Cryptococcosis

- Acute, subacute or chronic infection by Cryptococcus neoformans affecting brain, lungs, skin
- **Clinical features:**
  - Meningitis, focal neurological deficit
  - Fever, fluctuating remission - relapse over years
  - Cutaneous: Firm cystic EN like lesions, acneiform, umbilicated papules, plaques, nodules, Molluscum contagiosum like lesions

**Diagnosis:**
Microscopy with India ink preparation
Coccidioidomycosis

Primarily a respiratory fungal infection caused by *Coccidioides immitis*

- **Clinical features:**
  - Respiratory tract infection, may develop an acute disseminated fatal form

- **Diagnosis:**
  - KOH mount, serological test, skin test

- **Treatment:**
  - Amphotericin B, Ketoconazole, Itraconazole, Miconazole
**Paracoccidioidomycosis**

*Paracoccidioides brasiliensis* causes chronic granulomatous infection

**Clinical features:**
Primary lesions in mouth, nose, conjunctiva, anus, respiratory tract infection, ulcerating stomatitis, spleen, intestines, lungs, liver

- **Treatment:**
  Long acting sulfonamides, miconazole
Blastomycosis

Chronic granulomatous and suppurative mycosis by *Blastomyces dermatitidis*

- **Clinical features:**
  - Affects Lungs, skin, bones, CNS
  - Primary cutaneous following trauma
  - Cough, fever, chest pain, hemoptysis.
  - Dissemination to bones, CNS

- **Diagnosis:**
  - KOH mount; Culture

- **Treatment:**
  - Itraconazole, Iodides, Amphotericin B
Histoplasmosis

An infection caused by *Histoplasma capsulatum*

Clinical features:
Affects lungs, skin, Reticuloendothelial system, CNS, kidney.
Similar to TB: Presentation can be acute, chronic pulmonary & disseminated types.
Primary cutaneous infection: Papules, ulcers, nodules, granulomas, abscesses, fistulae, scars and pigmentary changes

Diagnosis:
Biopsy, blood, bone marrow aspiration, FNAC

Treatment:
Itraconazole, ketoconazole, Amphotericin B
Systemic Candidiasis

- Immunocompromised patients develop macules, papules or nodules with a pale centre. Some may become haemorrhagic.
- Some may develop a syndrome of Chronic Mucocutaneous Candidiasis (CMC) which consists of persistent oral thrush, cutaneous candidiasis, paronychia.
- **Treatment:**
  - IV Amphotericin B, Fluconazole
Thank you