Fungal Infections

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CONTENTS

Common cutaneous fungal infection

- Superficial - Due to fungi that involve fully keratinized tissue i.e. stratum corneum, hair and nails.
- Subcutaneous- These are the fungal infections that involve dermis and subcutaneous tissue.
- Deep mycoses - These involve the internal organs of the body along with the skin.

Superficial mycosis of skin

	Cutaneous disorder	Pathogen(s)
Minimal, if any, inflammation	Pityriasis(tinea) versicolor	*Malassezia furfur, M.globosa*
	Tinea nigra	*Hortaea werneckii*
	Black piedra	*Piedraria hortae*
	White piedra	*Trichosporon beigelli*
Inflammatory response common	Tinea capitis, barbae, faciei, corporis, cruris, manuum, pedis	*Trichophyton, Microsporum, Epidermophyton*
	Cutaneous candidiasis	*Candida albicans, other Candida spp.*

Predisposing factors

- Tropical climate
- Manual labour population
- Low socioeconomic status
- Profuse sweating
- Friction with clothes, synthetic innerwear
- Malnourishment
- Immunosuppressed patients - HIV, diabetes mellitus, congenital immuno - deficiencies, patients on corticosteroids, immunosuppressive drugs

Pityriasis versicolor

Etiologic agent :

- *Malassezia furfur*

Clinical features :

- Common among youth
- Multiple, discrete, discoloured, macules.
- Brown (hyperpigmented), grey or whitish - tan (hypopigmented)
- Pinhead sized to large sheets of discolouration
- Seborrheic areas : upper trunk and shoulder and arms
- Less frequently face (especially in children), scalp, anticubital fossae, submammary region and groin.

P. versicolor

- Inverse P. versicolor – involvement of flexural areas
- Hypopigmentation is due to inhibitory effects of dicarboxylic acid on melanocytes

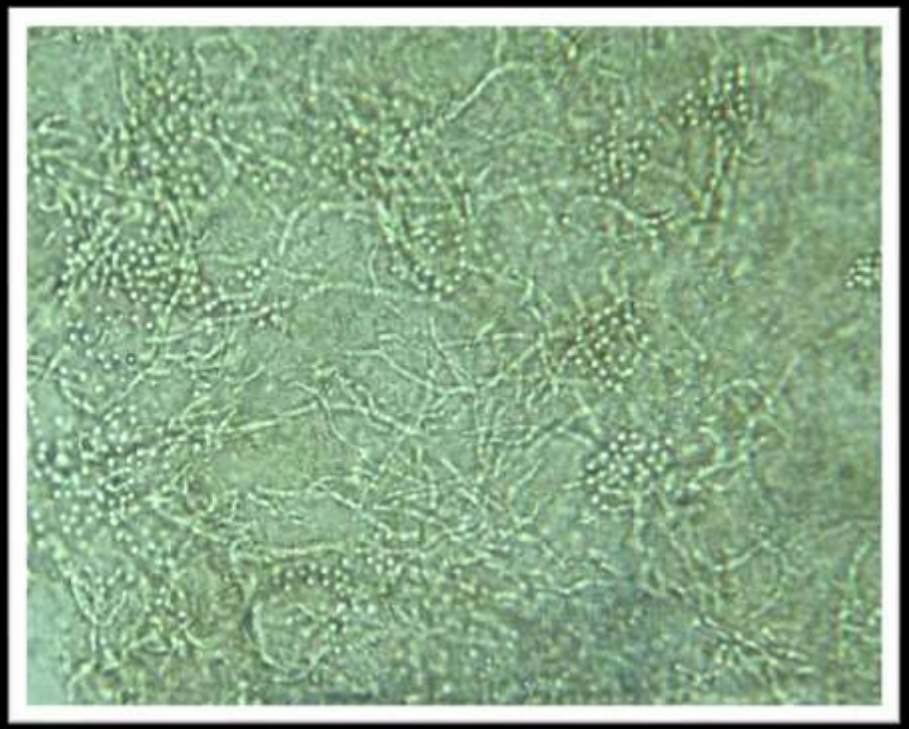
Wood's Lamp examination : Yellow fluorescence

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



On KOH mount

Pityrosporum folliculitis

Etiology : *Malassezia furfur & M. globosa*

Age group : Teenagers or young adult females

Clinical features :

Pruritic, monomorphic ,follicular papules and pustules scattered on the shoulders and back.

KOH : only yeast forms - **no hyphal forms.**

Tinea nigra palmaris

Etiology : Exophiala werneckii

Clinical features :

- Single sharply marginated, brown or grey-green patch, velvety/mild scaling.
- Asymptomatic superficial infection of palms; resembling a silver nitrate stain.

Piedra

It is superficial fungal infection of hair shaft

	White piedra	Black piedra
Causative organism	*Trichosporon beigelii*	*Piedraia hortae*
Nodule colour	White(occasionally red, green or light brown)	Brown to black
Nodule firmness	Soft	Hard
Nodule adherence to the shaft	Loose	Firm
Typical anatomical location	Face, axillae and pubic region (occasionally scalp)	Scalp and face (occasionally pubic region)

Piedra

It is superficial fungal infection of hair shaft

	White piedra	Black piedra
Favoured climate	tropical	tropical
KOH examination of “crush prep“ of cut hair shaft	Non dematiaceous hyphae with blastoconidia and arthroconidia	Demacious hyphae with asci and ascospores
Culture on SDA	Moist cream coloured yeast like colonies	Slow growing, dark green to dark brown- black colonies

Dermatophytosis

These are fungal infections that invade and multiply within keratinised tissue- skin, hair & nails

Category	Mode of transmission	Typical clinical features	Etiological agents
Anthropophilic	Human to human	Mild to non-inflammatory, chronic	*T. rubrum* *T. tonsurans* *T. concentricum* *T. mentagrophytes (var. interdigitale)* *Epidermophyton floccosum*

Dermatophytosis

These are fungal infections that invade and multiply within keratinised tissue- skin, hair & nails

Category	Mode of transmission	Typical clinical features	Etiological agents
Zoophilic	Animal to human	Intense inflammation (pustules and vesicles possible), acute	*T. mentagrophytes (var.mentagrophytes)* *Microsporum canis* *T. Verrucosum*
Geophilic	Soil to human or animal	Moderate inflammation	*M. gypseum*

Pathogenesis

Contact

↓ host factors

Adherence

↓ Keratinases

Invasion of fungi in stratum corneum

Protease inhibitors, β-globulins, Mannans ↓ Inhibitory factors-sebum, ferritin

Disease

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 Corporis

- Dermatophytosis of the trunk and extremities with the exclusion of the palms (tinea manuum), soles (tinea pedis) and groins (tinea cruris).
- Incubation period- 1-3 weeks.
- All species of dermatophytes can cause this.
- Three most common causative organisms are *T.rubrum> T. mentagrophytes > M. canis.*
- In India*, T. rubrum* is most common.

Tinea Corporis

- Centrifugally spreading from point of skin invasion with centrally clearing, a typically annular lesion (ring like)
- Morphological variants - arcuate, circinate & oval
- Clinical variants

  Tinea profunda

  Majocchi's granuloma

  Tinea imbricata

Classical Tinea Corporis

Recalcitrant and eczematized Tinea Corporis

Differential diagnosis

- Nummular eczema
- Petaloid type of seborrheic dermatitis
- Pityriasis rosea
- Parapsoriasis
- Erythema annulare
- Subacute lupus erythematosus
- Granuloma annulare
- Annular psoriasis

Tinea cruris

- Dermatophyte infection of inguinal region
- Area of erythema and pruritus in fold between scrotum & inner thigh
- Characteristic sharply demarcated with raised, erythematous, scaly advancing border that may contain pustules and vesicles

Tinea manuum

- Dermatophytic infection of palm and interdigital space.
- Reason for different clinical picture- related to lack of sebaceous glands on palm.

Two varieties :

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

Tinea faciei

- Erythematous scaly patches on the face
- Annular or circinate lesions and induration with pustules on border
- Itching, burning and exacerbation after sun exposure
- Almost always associated with tinea of other body parts
- Seen often in immuno-compromised adults

Tinea barbae

- Dermatophytosis of the bearded areas of face and neck
- Highly inflammatory, pustular folliculitis as caused by mainly zoophilic fungus
- Hairs of the beard or moustache are surrounded by inflammatory papulo-pustules, usually with oozing or crusting, easily pluckable
- Complications - abscesses, sinus tracts, bacterial super-infections , kerion like boggy swellings, alopecia
- D/D - Sycosis barbae, Acne vulgaris, Pseudofolliculitis

Tinea Barbae

Tinea capitis

- Infection of the scalp and hair
- Commonest mycosis observed in children
- Caused by dermatophytes in the genera Microsporum and Trichophyton. Epidermophyton is not traditionally isolated
- In North America *T. tonsurans* is most common while in Europe, M. canis is the most common agent

TYPES :

- Non-inflammatory : Gray patch , Black dot
- Inflammatory : Favus , Kerion

Tinea capitis

Three patterns of invasion exist;

- **Endothrix pattern** - infection with anthropophillic fungi by non-fluorescent anthroconidia within hair shaft

  T. tonsurans, T. violaceum

- **Ectothrix pattern-** anthroconidia formed from fragmented hyphae outside the hair shaft, fluorescent or non fluorescent.

- **Favus** - hyphae and air spaces within the hair shaft and a bluish-white fluorescence.

Gray patch

- Ectothrix pattern of invasion
- Patches of partial hair loss
- Often circular in shape
- Numerous “broken-off” hairs that are dull grey and lustreless due to the overcoating by arthrospores
- Causes epidemics in schools

Etiologic Agent : *Microsporum audouinii*

- Asymptomatic or complain of mild itching

Tinea capitis

Black dot tinea capitis

- Endothrix pattern of invasion.
- Hair shaft is brittle and breaks at the level of the scalp, remnant of the hair left behind in the infected follicle appears as a black dot on clinical examination
- Diffuse scaling with minimal hair loss or inflammation
- Affected areas of hair loss are characteristically multiple and polygonal in outline with distinct finger like margins.
- Commonly spare some hair within the areas of involvement

Black dot tinea capitis

Kerion

- Mostly due to infection with *T. verrucosum* or *T. mentagrophytes*.
- Inflammed boggy and indurated tender swelling that is studded with broken or unbroken hairs, vesicles and pustules.
- Sinus formation and thick crusting with matting of adjacent hair
- Lymphadenopathy and secondary bacterial infection
- Heals with scarring & autoeczematisation(id eruption)

Kerion

Favus

A yellow cup shaped crust composed of a dense mat of mycelia and epithelial debris called scutulum (shaped like a shield)

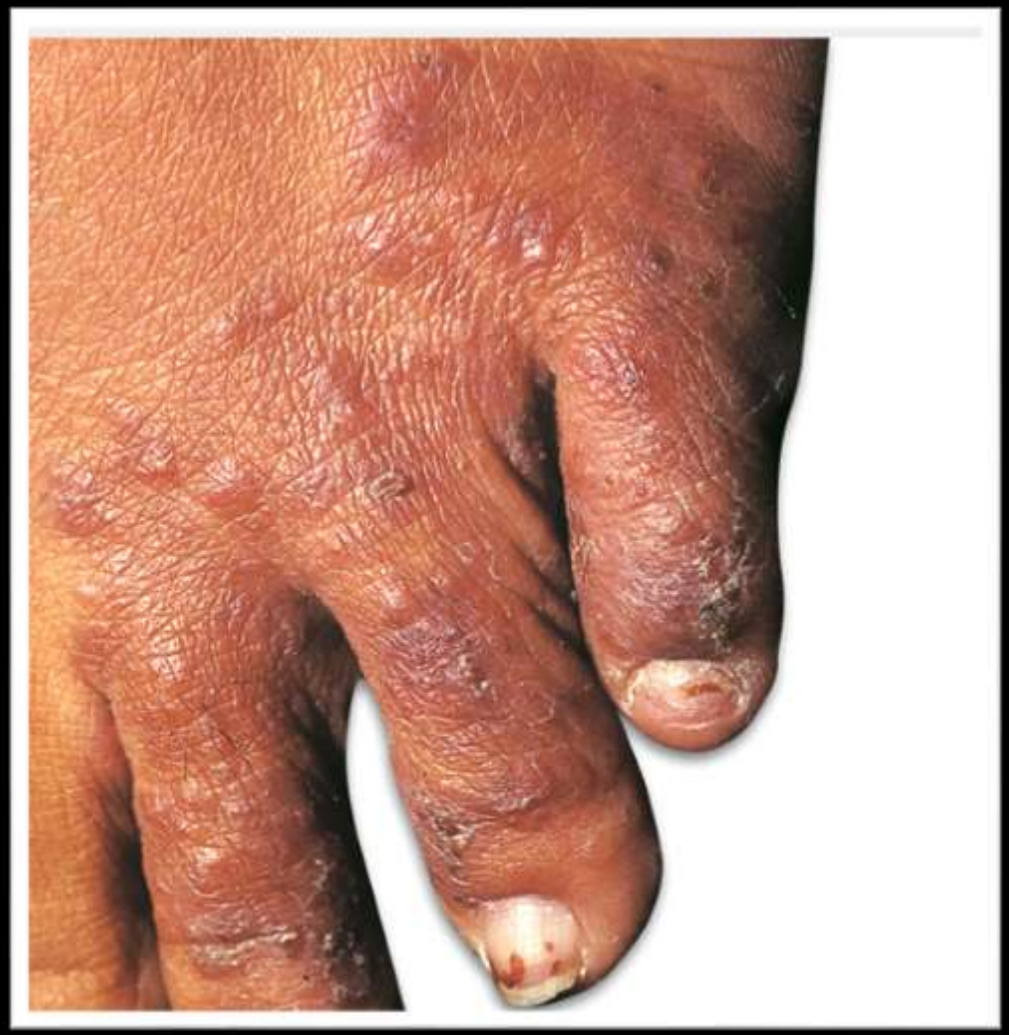
- The scutulae enlarge and merge to form prominent yellowish crusts.
- Characteristic mousy odour
- Borders of the infected lesions represent areas of advancing disease and are often polycyclic in shape & centre of the infected area gradually becomes extensively scarred and almost totally devoid of hair.
- Later stage - cicatricial alopecia.
- Commonest cause - *T. schoenleinii*

Tinea pedis

Type	Causative organism	Clinical features
Moccasin	*T. rubrum* *E. floccosum*	Diffuse hyperkeratosis, erythema, scaling and fissures on one or both plantar surfaces
Interdigital	*T. mentagrophytes (var. interdigitale)* *T. rubrum* *E. floccosum*	Most common type, erythema, scaling, fissures and maceration in web spaces, pruritus common, extend to dorsum and sole of foot

Tinea pedis

Type	Causative organism	Clinical features
Inflammatory (vesicular)	*T. mentagrophytes (var. mentagrophytes)*	Vesicles and bullae on medial foot; associated with dermatophytid reaction
Ulcerative	*T. rubrum* *T. mentagrophytes* *E. floccosum*	Exacerbation of interdigital tinea pedis; ulcers and erosions on web spaces; secondary infection with bacteria



Tinea pedis

Tinea unguium

- Onychomycosis - all fungal infections of nails including dermatophytes and non-dermatophytes.
- Tinea unguium - Dermatophytic Onychomycosis
- 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 onychomycosis
- Proximal subungual onychomycosis
- White superficial onychomycosis
- Total dystrophic onychomycosis

Tinea unguium

- Toenail > Fingernail
- Men > Women
- Trauma - predisposing factor

Most common pathogens -

- *T. rubrum,*
- *T. mentagrophytes*
- *E. floccosum*

Treatment

Topical :

- Clotrimazole cream
- Ketoconazole cream
- Miconazole cream
- Econazole cream
- Sertaconazole
- Luliconazole
- Amlorifine

Oral Treatment

Oral drug	Dose
Fluconazole	150-200mg per week
Griesofulvin	500-750 mg/ day
Itraconazole	200-400 mg/day
Terbinafine	250 mg o.d.

Duration of Treatment

Condition	Duration
Tinea corporis	4-6 weeks
Tinea cruris	2-4 weeks
Tinea manuum	1-4 weeks
Tinea faciei	4-6 weeks
Tinea pedis	4-8 weeks
Tinea capitis	6-8 weeks
Tinea unguium Finger nails : Toe nails :	 12-24 weeks 24- 36 weeks

Candidiasis

Causative organism :

- *Candida albicans, Candida krusei, Candida parapsilosis, Candida tropicalis, Candida pseudotropicalis*.

Sites of Carriage :

- Cutaneous
- Gastrointestinal
- Vaginal

Sites of affection :

- Mucous membrane
  Oral candidiasis, Vulval candidiasis, Candidial Balanitis
- Skin
- Nails

Types

Oral Candidiasis :

It can present as :

- Thrush (white exudates resembling cottage cheese; pseudo membranous form)
- As a patch of erythema (Chronic Atrophic form)
- Adherent white plaques(Chronic Hyperplasic type)
- **Angular cheilitis (perleche) :** Soreness at the angles of mouth

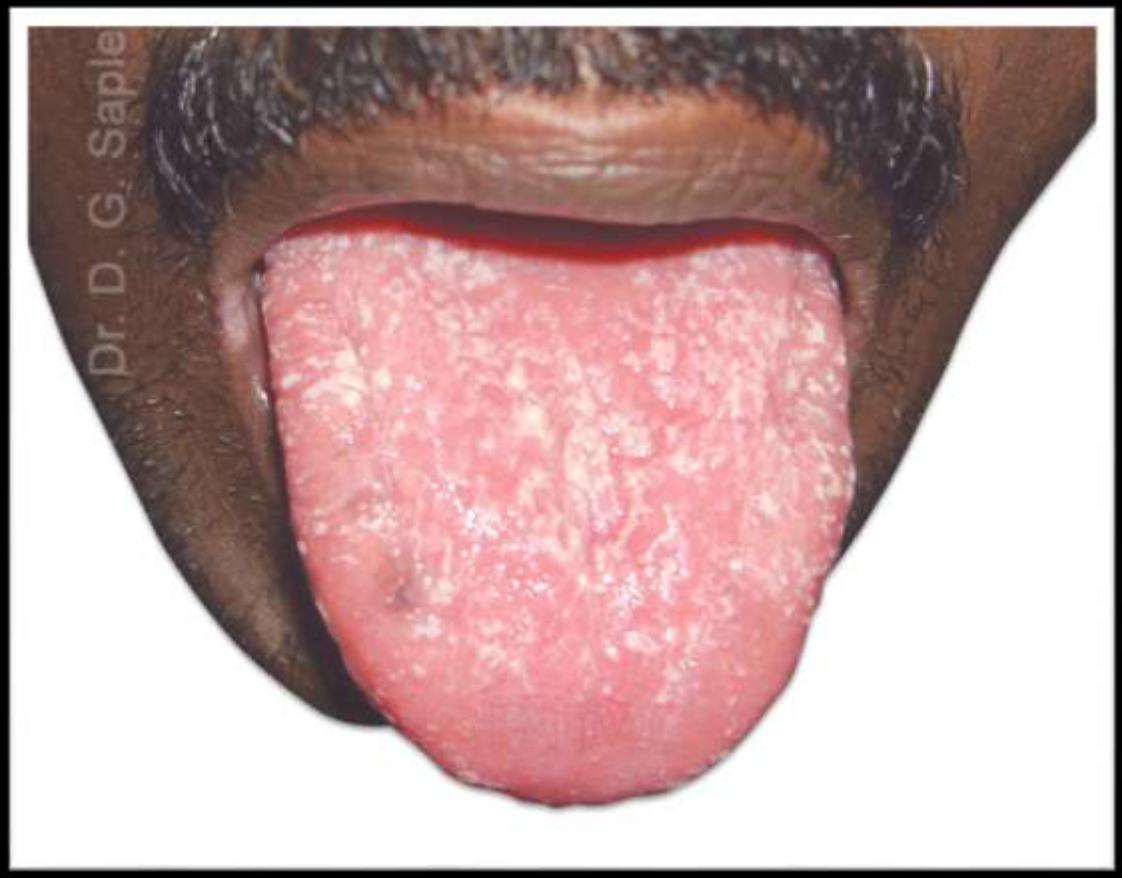
Sites :

- Immuno-competent patient: cheeks, gums or palate
- Immuno-compromised patient: affection of tongue with extension to pharynx or oesophagus; ulcerative lesions may occur

Vulvovaginitis : 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.



Oral Candidiasis

Flexural Candidiasis

Intertrigo :

- Retention of moisture, increased temperature and maceration in the folds favour the growth of candida in these areas.
- 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.

Treatment

- Treat the predisposing factors like poor hygiene, diabetes, AIDS, conjugal infection.
- **Topical :**

  Clotrimazole, Miconazole, Ketoconazole, Ciclopiroxolamine.
- **Oral :**

  Ketconazole 200mg (1-2 weeks),

  Itraconazole 100-200mg (2-3 weeks) and

  Fluconazole 150 mg (1 week)

Subcutaneous fungal infections

These are the fungal infections that involve dermis and subcutaneous tissue

- Mycetoma
- Chromoblastomycosis
- Sporotrichosis

Mycetoma-Madura foot

Clinical features :

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

Mycetoma-Madura foot

Causative organisms

Eumycotic mycetoma

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

Actinomycetoma

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

Eumycotic mycetoma	Actinomycotic mycetoma
Slowly invasive	Rapidy invasive
Late presentation, as it is relatively asymptomatic	Early presentation
No pus	Pus present
Black brown granules	Granules yellowish white
More deformity	Less deformity
Granules 4-5 micron, in clusters	Granules < 1 micron lie singly
Gram -ve GMS, PAS +ve	Gram + ve ,GMS PAS – ve
Responds to antibiotics (sulphonamides, doxyclines)	Responds to antifungals (Itraconazole, amphotericin B)

Chromoblastomycosis

- A chronic fungal infection of skin and subcutaneous tissue
- Verrucous dermatosis
- Cladosporiosis

Organisms :

- *Phialophora verrucosa, P. pedrosoi, P. compactum,*

  Wangiella dermatitidis, Cladosporium carrionii, Fonsecaea sp.

Clinical Features:

- Warty papule enlarges to expanding verrucous plaque; commonly on feet, legs, neck, face.
- Lower > upper extremity. Men 20-60 years.
- Tropical climate> Temperate climate.
- Farmers, miners at higher risk- exposure to soil and decaying plants and wood.

Biopsy : Copper pennies, Medlar bodies, Sclerotic bodies.

Treatment :

- Surgical excision, Cryotherapy, Amphotericin B, Itraconazole

Chromoblastomycosis

Sporotrichosis

- Rose gardener's disease
- Caused by Sporothrix schenckii-dimorphic fungus.

Clinical features:

- Localized lymphatic variety- Sporotrichoid pattern; 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.

Pathogenesis

Single papule at the site of injury (mostly hands)

↓

Erosion, ulceration, purulent drainage (generally not painful)

↓

Dermal and subcutaneous nodules along path of lymphatic drainage

↓

Biopsy-Cigar shaped yeast cells with PAS and Silver stains.

Treatment :

Systemic fungal infection

These are divided in two groups

- **Endemic mycosis :** may involve any of the internal organs of the body along with the skin.
- **Opportunistic mycosis :** occur in immunosuppressive states.

Histoplasmosis

- An infection caused by *Histoplasma capsulatum* -dimorphic fungus.
- Systemic fungal infection.

Clinical features :

- Affects lungs, skin, reticulo-endothelial 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-parasitized macrophages
- Blood, Bone marrow aspiration, FNAC

Treatment :

- Itraconazole, ketoconazole, Amphotericin B.

Blastomycosis

- Chronic granulomatous and suppurative mycosis by dimorphic fungus, *Blastomyces dermatitidis*.

Clinical features :

- Affects lungs, skin, bones, CNS
- Primary cutaneous occurs following trauma-papulopustules and verrucous plaques with scales and crusting.
- Central ulceration and cribriform scarring.
- Adult men-Systemic infection more common.
- Children-Acute pulmonary .
- Exposure to soil.

Diagnosis :

- KOH mount -Broad -based budding, thick double contoured walls.
- Biopsy
- Culture

Treatment :

- Itraconazole
- Ketoconazole, Fluconazole, Iodides
- Amphotericin B

Systemic Candidiasis

- Immuno-compromised patients develop macules, papules or nodules with a pale centre.
- Some may become haemorrhagic.
- Some may develop a syndrome of Chronic Mucocutaneous Candidiasis and Paronychia.

Treatment :

- IV Amphotericin B
- Fluconazole

Coccidioidomycosis

- Also known as - Posada's disease, San Joaquin's Valley fever, Desert Rheumatism
- Primarily a respiratory fungal infection caused by *Coccidioides immitis.*

Clinical features :

- Respiratory tract infection, may develop an acute disseminated fatal form.
- Cutaneous manifestations-papules, pustules, plaques, abscess and sinus tracts with face being the most common site of involvement.

Diagnosis :

- KOH mount-Barrel shaped anthroconidia
- Histology
- Serological tests

Treatment :

- Self limiting in majority of cases.
- Amphotericin B, Ketoconazole, Itraconazole, Miconazole can be given.

Paracoccidioidomycosis

- Also known as South American Blastomycosis, Brazilian Blastomycosis
- *Paracoccidioides brasiliensis* causes chronic granulomatous infection.

Clinical Features :

- Mucocutaneous involvement is seen in progressive disseminated disease.
- Lesions are often painful and ulcerative.
- Nasal and oral mucosa most commonly involved.

Treatment :

Cryptococcosis

- Caused by *Cryptococcus neoformans* - affects brain, lungs and skin.
- Mostly associated with immunodeficiency syndrome.

Clinical features :

- Meningitis, focal neurological deficit.
- Cutaneous findings-Firm cystic EN- like lesions, acneiform lesions, umblicated papules, plaques and nodules.
- Molluscum contagiosum like lesions.

Diagnosis :

- Microscopy - India ink preparation

Treatment :

- Fluconazole- first line of therapy.
- Amphotericin B and Flucytosine combination for severe meningeal and

Opportunistic fungal infections

Mycosis	Common cutaneous presentation
Systemic Candidiasis	Firm erythematous papule and nodule with pale centre
Aspergillosis	Necrotic papulonodules, Subcutaneous nodules Disseminated disease from primary pulmonary involvement.
Zygomycosis	Ecthyma gangrenosum like lesions, cellulitis, facial edema, plaques, large haemorrhagic crusts on face
Cryptococcosis	Ulceration, cellulitis, Molluscum contagiosum like lesions

Mycosis	Common cutaneous presentation
Phaeohyphomycosis	Subcutaneous cysts, ulcerated plaques, haemorrhagic pustules, necrotic papulonodules
Hyalohyphomyosis	Umblicated or necrotic papulopustules, abcesses, cellulitis, subcutaneous nodules,
Trichosporonosis	Papulovesicles, purpuric papules, necrotic papulonodules

MCQ'S

Q.1) Most common type of tinea unguium in HIV patients

A. Distal and lateral

B. Proximal subungual

C. White superficial

D. Total dystrophic

Q.2) Rose gardener's disease is

A. Sporotrichosis

B. Chromoblastocosis

C. Histoplasmosis

D. Blastomycosis

Q.3) Which is diagnosed by Indian Ink preparation?

A. *Histoplasma capsulatum*

B. *Cryptococcus neoformans*

C. *Candida tropicalis*

D. *Coccidiodes immitis*

Q.4) Which of the following is Geophillic fungus?

A. *T. Tonsurans*

B. *T. Concenticum*

C. *M. Gypseum*

D. *Microsporum canis*

Q.5) “Spaghetti and meatball” appearance is seen in

A. Piedra

B. Tinea nigra

C. P. versicolor

D. Chromoblastomycosis

Q.6) Which of the following called Jock’s itch?

A. Tinea cruris

B. Tinea corporis

C. Tinea pedis

D. Tinea unguum

Photoquiz

Q. 7) Identify the condition

Photoquiz

Q.8) Identify the condition

Q. 9) Identify the condition

Thank You!