

# **Cutaneous and mucosal diseases caused by fungi (Mycoses)**

Nóra Erós M.D.

# Medically important fungi

## Obligatory pathogenic:

- dermatophytes
- dimorphic fungi

## Facultative pathogenic:

- yeasts
- moulds

# I. Dermatophytes

## 1./ *Microsporum* genus

- **anthropophilic organisms:** *M. audouinii*, *M. ferrugineum*
- **zoophilic:** *M. canis*
- **geophilic:** *M. gypseum*

## 2./ *Epidermophyton* genus

- **anthropophilic:** *E. floccosum*

## 3./ *Trichophyton* genus

- **anthropophilic:** *T. rubrum*, *T. interdigitale*, *T. violaceum*, *T. tonsurans*, *T. soudanense*, *T. schoenleinii*, *T. concentricum*
- **zoophilic:** *T. mentagrophytes* zoophilic variants, *T. verrucosum*, *T. equinum*
- **geophilic:** *T. terrestre* (nonpathogenic)

# II. Yeasts

- **Candida species**
  - C. albicans
  - non-albicans species:
    - C. glabrata
    - C. tropicalis
    - C. parapsilosis
    - C. krusei
    - C. guilliermondii
- **Cryptococcus neoformans**
- **Malassezia furfur**

# III. Moulds

- *Scopulariopsis brevicaulis*
- *Aspergillus fumigatus*
- *Aspergillus niger*
- *Aspergillus flavus*
- *Mucor* species
- *Rhizopus* species
- *Penicillium marneffe*

# IV. Dimorphic fungi

- *Histoplasma capsulatum*
- *Coccidioides immitis*
- *Blastomyces dermatitidis*
- *Paracoccidioides brasiliensis*
- *Sporothrix schenckii*

# Dermatophyte infections

# 1. Tinea capitis

- **forms: superficial, deep mycosis**
- **pathogens: Microsporum and Trichophyton species**
- **a./ microsporia capitis**
- **b./ trichophytia capitis**
- **c./ favus**

# **Microsporia capitis**



**Pathogens: *M. audouinii*, *M. canis*, *M. gypseum***  
**Clinical findings: mild erythema, scaling, broken hairs**

# **Trichophytosis superficialis, Deep trichophytosis (Kerion Celsi)**

**Pathogens: T.mentagrophytes, T.verrucosum, etc.**

**Clinical findings: circular, erythematous, swollen lesions, scaling**

# Favus

**Pathogens: T. schoenleinii, T. violaceum**

**Clinical findings: yellow, dish-shaped crusts (scutulas), hair loss,  
irreversible scarring alopecia**

## **2. Tinea barbae**

- **deep mycosis, only in adult men**
- **pathogen: Trichophyton mentagrophytes**
- **differential diagnosis: folliculitis, furuncle, carbuncle, acne**

**pustules, purulent discharge, redness, scaling, papules,  
nodules, abscesses, hairs can be pulled out**

### **3. Tinea faciei, corporis (ringworm)**

- **mainly in children who are infected by domestic animals**
- **pathogens: Trichophyton, Microsporum, Epidermophyton sp.**
- **face, trunk, extremities**

**itching erythematous circular lesions, scaling, pustules at the border**

## 4. Tinea cruris

- pathogens: **Trichophyton, Epidermophyton species**
- **genital region, groin, perineal, perianal skin**
- **can be caused by yeasts**

## 5. *Tinea manuum*

- forms: interdigital, papulosquamous, dysidrosiform
- pathogens: *Trichophyton* species
- differential diagnosis: eczema, psoriasis, atopic dermatitis, palmoplantar hyperkeratosis

**unilateral, erythematous, scaling, hyperkeratosis, sometimes  
dysidrosiform vesicles, interdigital erosions**

## 6. Tinea pedis

- **forms: interdigital (athlete's foot), squamous-hyperkeratotic (moccasin-type), dysidrosiform-vesicular**
- **pathogens: Trichophyton species**
- **differential diagnosis: bacterial infection, psoriasis, palmoplantar hyperkeratosis**

# Mocassin-type tinea pedis

## 7. Onychomycosis (*Tinea unguium*)

- **pathogens: dermatophytes, yeasts, moulds**
- **clinical forms:**
  - **distal-lateral subungual onychomycosis (DLSO)**
  - **proximal subungual onychomycosis (PSO)**
  - **white superficial onychomycosis (WSO)**
  - **endonyx onychomycosis**
  - **total dystrophic onychomycosis (TDO)**

# **Distal-lateral subungual onychomycosis (DLSO)**

# Proximal subungual onychomycosis (PSO)

# White superficial onychomycosis (WSO)

# Endonyx onychomycosis

# Total dystrophic onychomycosis (TDO)

# Yeast (Candida) infections

# 1. Candida intertrigo

**sharply demarcated erosion, erythematous center, scaling or pustular border, in intertriginous areas (body folds)**

## 2. Candida folliculitis

**small follicular pustules, yellow crusts**

### **3. Candida paronychia**

### **4. Onychomycosis**

**erythematous, swelling nail fold, purulent discharge, discoloration of the lateral nail plate**

## 5. Diaper dermatitis (napkin rash)

**Clinical findings: maceration, erosion, erythema, pustules, sometimes scaling**

## 6. Oral candidosis

- **angulus infectiosus oris**
- **cheilitis**
- **median rhomboid glossitis**
- **black hairy tongue**
- **oesophagitis**
- **tonsillitis**

# Angulus infectiosus oris (Angular cheilitis)

**bilateral erythema, erosions, crusts at the corners of the mouth**

# Candidosis of the tongue

**white, leukoplakia-like  
plaques or loose patches on  
the tongue / palate / buccal  
mucosa**

# Black hairy tongue

**brownish-black discoloration, velvety surface**

## 7. Genital candidosis

- **Vulvovaginitis**
  - **uncomplicated form: mild-to-moderate, sporadic, nonrecurrent disease, caused by C. albicans**
  - **complicated form: recurrent disease in predisposed women, caused by non-albicans Candida species**
  - **differential diagnosis: gonorrhoea, trichomoniasis, mycoplasma/ureaplasma/chlamydia infections, bacterial vaginitis**
- **Balanitis, balanoposthitis**
  - **differential diagnosis: contact dermatitis, psoriasis, erythroplasia Queyrat, lichen planus**

**Clinical findings: creamish white vaginal discharge,  
erythema, swelling, itching**

**Clinical findings: circumscribed erythema, scaling , itching**

# **Disorders caused by *Malassezia furfur* (*Pityrosporum ovale*)**

## **Malassezia furfur (Pityrosporum ovale):**

- yeast
- mainly in regions where sebaceous glands are most active: scalp, face, presternal area, body folds

### **Disorders:**

- 1./ Pityriasis versicolor
- 2./ Seborrhoeic dermatitis
- 3./ Pityrosporum folliculitis

# 1. Pityriasis versicolor

**sharply demarkated reddish-brown or white macules**

## 2. Seborrhoeic dermatitis

**orange-red plaques, white dry scaling, Scalp: „dandruff”**

# Diagnosis of mycotic infections

# Laboratory diagnosis of mycoses

- 1. Microscopic analysis**
- 2. Culture**
- 3. Isolation**
- 4. Identification**
- 5. Resistance analysis**

# Specimen collection

- **skin: scrapings of scales from the border of skin lesion**
- **hair: pulling out from the roots**
- **nail: scrapings from the deepest region above the nail plate**
- **mucosal surfaces (ie. mouth or vagina): moist swab**
- **skin biopsy in some cases**

# Microscopic analysis

- **light microscope, magnification: 400-600x**
- **direct microscopic investigation, stained with KOH mount (10-30%), methylene blue, Gram's stain or India ink**

# Culture

- **isolation on fungal media:**
  - **Sabouraud glucose agar, Sabouraud + chloramphenicol agar, Sabouraud + chloramphenicol + actidione agar, Yeast extract agar, Czapek-Dox agar**
- **identification:**
  - **special media**
- **incubation time : 5-21 days**
- **temperature : 26-37°C**

# Serology

**Serological tests are not useful for the diagnosis of superficial fungal infections!**

- **antibody detection**
  - **double diffusion: candidosis, aspergillosis**
  - **immunofluorescence: candidosis**
- **antigen detection**
  - **latex agglutination: cryptococcosis, candidosis, aspergillosis**
  - **ELISA: cryptococcosis**

# Treatment of mycotic infections

# Antimycotic treatment

**1./ Systemic**

**2./ Topical**

**3./ Combined**

# Systemic treatment

- **Polyenes:**
  - amphotericin B
  - nystatin
- **Griseofulvin**
- **5-fluorocytosine**
- **Allylamines:**
  - terbinafine
- **Azoles:**
  - **imidazoles: miconazole, ketoconazole**
  - **triazoles: fluconazole, itraconazole, voriconazole**

# AZOLES

## Ketoconazole

- spectrum: dermatophytes, *Candida*, *Malassezia furfur*, dimorphic fungi
- mode of action: ergosterol synthesis inhibition
- side effects: hepatotoxicity
- administration: p.o., dose depends on the infection, 200-400 mg/d

## Fluconazole

- spectrum: yeasts, dimorphic fungi, (dermatophytes)
- mode of action: ergosterol synthesis inhibition
- resistance: *Candida krusei* (natural resistance), *C. glabrata* (dose-dependent)
- administration: oral, parenteral
  - oropharyngeal infections: 50-100 mg/d, for 7-14 days
  - acute vulvovaginal candidosis: 1x150 mg
  - chronic, recurrent VVC: 1x150 mg/month, for 4-12 months

# AZOLES

## Itraconazole

- spectrum: yeasts, dermatophytes, dimorphic fungi, Aspergillus, some moulds
- mode of action: binding to cytochrome P-450 enzyme of fungi, ergosterol synthesis inhibition
- administration: oral
  - tinea corporis, oral candidosis: 100 mg/d, for 15 days
  - vulvovaginal candidosis: 200 mg/d for 3 days
  - onychomycosis: 2x200 mg/d for 1 week followed by 3 weeks without treatment („pulse therapy”)

## Voriconazole

- spectrum: Aspergillus, yeasts, dimorphic fungi, dermatophytes
- mode of action: fungicidal
- administration: i.v.

# ALLYLAMINES

## Terbinafine

- spectrum: dermatophytes, (some yeasts, moulds, dimorphic fungi)
- mode of action: fungicidal or fungistatic, squalene epoxidase enzyme inhibitor
- resistance: moulds, dimorphic fungi
- administration: p.o., 250 mg/d for 2-24 weeks depending on the form of disease
- pediatric formulation: p.o. 125 mg/d

# Topical treatment

- **Imidazoles:**
  - clotrimazole (solution, cream, vaginal tablets, spray)
  - ketoconazole (cream, shampoo)
  - econazole (cream)
  - omoconazole (solution, cream, vaginal suppository)
  - sertaconazole (cream)
  - flutrimazole (gel)
- **Allylamines:**
  - terbinafine (cream, solution, gel, spray)
- **Morfoline:**
  - amorolfine (cream, nail lacquer)
- **Polyenes:**
  - natamycin (cream, solution, vaginal tablets, vaginal suppository)
- **Others:**
  - tolnaftate (spray, powder)
  - cyclopyroxolamine (solution, cream, vaginal cream, powder, nail lacquer)

# Predisposing factors of mycoses

## 1. Intrinsic

### Physiological

- age
- stress
- pregnancy
- malnutrition
- gender

### Pathological

- neutropenia
- diabetes
- malignant tumours
- preceding viral/bacterial disease

# Predisposing factors of mycoses

## 2. Extrinsic

### Physical

- burn
- prostheses
- occupational exposure
- trauma
- irradiation

### Surgical

- indwelling catheters
- transplantation
- cardiac and abdominal surgery

### Drugs

- corticosteroids
- immunosuppressive drugs
- cytotoxic therapy
- broad-spectrum antibiotics
- contraceptive pills