Fungal Infections Cheat Sheet

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Tinea Pedis

1. Acute Vesicular	T.mentagrophytes and sometimes E.floccosum
	Small vesicles, vesiculopustules and/or blisters typically seen near instep.
	Treatment: Topical anti-fungal
2. Chronic Papulo-squ-amous	T.ruburm, sometimes T.mentagrophytes
	Often assoc. with hereditary palmoplantar keratoderma
	Thick, boggy yellow to brown hyperkeratosis with peripheral scaling and/or fissures.
	Usually bilateral. Characterized by a moccasin-like distribution. Hands may be infected as well. most common pattern is for both feet and one hand to be involved. When both hands and feet are infected, T.mentagrophytes is the organism
	Treatment: Debridement, topical anti-fungal and urea based emollient. May need oral
3. Chronic Interd-igital	T.mentagrophytes and sometimes T.rubrum and E.floccosum
	Fissuring, scaling, and maceration in the toes spaces.
	Hyperhidrosis is typically the cause
	Treatment: Wash and DRY in between toes. Can use cotton balls to place in between toes to absorb moisture. Can use Drysol products for feet and shoes. Can use alcohol spray to dry out area. If wear boots, use boot dryer to prevent moisture. Use sprays not cream. If use cream, needs to be completely rubbed in. Clean shoes and change socks every day.
4. Acute Ulcerative	T.mentagrophytes and can be complicated by grm- bacteria
	Presents with maceration, weeping, and ulceration of the sole with assoc. white hyperkeratosis and odour
	Need to rule our secondary infection by bacterial cultures and gram stains.
	Treatment: Oral antibiotics and topical anti-fungal

Most commonly caused by T. rubrum, T.mentagrophytes. E.floccosum

Diagnosis of Mycological Conditions

Clinical Presentation

KOH micros-copic evaluation	Nail or skin clipped and placed in 10% KOH solution. Observe under microscope for septa and branching hyphae
Fungal Cultures	Sabouraud's dextrose agar most common fungal mediym
Biopsy	Only used when concerned about malignancy. Can be examined with periodic acid schiff

Dermatophytes are group of fungi capable of colonizing keratinized tissues such as the stratum corneum, nails and hair. They use keratin as a source of nutrients.
Three Genera of Dermatophytes: 1) Micros-

Deep Fungal Infections (cont)

Echinocandins- Inhibitors of Fungal Wall Synthesis (cont)

porum 2) Trichophyton 3) Epidermophyton

Deep Fungal Infections

Majocchi's Granuloma	caused by T.rubrum
	Starts as a fungal folliculitis and spreads into the dermis where it forms an inflammatory nodule
	clinically, there is a erythematous plaque with indistinct borders and no central clearing
	Oral therapy is necessary
Sporotrichosis	Secondary to sporothrix schenckii
	introduced into the dermis traumatically from thorns or splinters with the conidia
	Happens in gardeners
	Starts as a papule that becomes a painless ulcer with a ragged undermined red border. May follow lymphatics so wont respond to a topical.
	Tx: potassium iodide PO, Amphotericine B IV, PO itraconazole or terbinafine
Chromoblastomycosis	Caused by species pf phialophora, fonsecaea and cladosporium
	Nodule develops and ulcerates followed by scales, crust and scarring and keloid formation
	Tx: local heat, same as for sporotrichosis. Need to consult with infectious disease specialist

Polyenes- Inhibitors of Fungal Membrane Stability

MOA of Nystatin:	Binds to ergosterol and produced channels/pores that alter fungal membrane permeability -> leakage of cell contents -> cell death
Nystatin Cream	mitte: 15g or 30g tube or 450g jar, sig: apply to affected areas of skin on feet twice a day for four weeks
	uses: candida infections (and to lesser extent dermatophyte infections) of the skin and mucosa

Echinocandins- Inhibitors of Fungal Wall Synthesis

MOA	Target fungal cell wall synthesis by inhibiting synthesis of B-(1,3)-D glucans (a key component in the fungal cell wall). Disruption of cell wall integrity -> osmotic stress -> lysis of fungal cell -> fungal cell death
Ciclopirox (Topical)	1% cream, mitte: 45g tube sig: applied twice a day to affected areas of skin for 4 weeks. Good for dermatophyte and candida infections of the skin
	1% lotion (loprox) mitte: 60ml bottle sig: applied twice a day to affected areas of skin for 4 weeks
	Nail Lacquer 8% (Penlac) mitte: 6.6ml bottle with brush applicator sig: apply once a day to all affected nails for 6-9 months. Remove build up with alcohol or nail polish remover every 7-10 days. Loprox and penlac are good for skin and nails
	MOA: Chelates metal ions in fungal membrane which increase fungal cell membrane permeability (inhibits membrane transfer system by interrupting na/K/ATPase) -> fungal cell death
	Effective against some bacteria
	exerts anti inflammatory activity by inhibiting 5-lipoxygenase and COX enzymes
Tolnaftate	topical: OTC powder (tinactin), gel and cream. unknown MO. Good for tinea versicolour and mild dermatophytes infections of skin

Echinocandins- Inhibitors of Fungal Wall Synthesis (cont)

Undecycline Acid	topical: OTC power (desenex), cream, spray (tolcylen) Unknown MOA. Used as preventative or adjunct. Uses: candida and mild dermatophyte infections of skin

Routine debridement will help decrease fungal load and help with drug penetration !!

Tinea Ungium/ Onychmycosis

Caused by:	E.floccosum, T.rubrum, T.mentagrophytes
Toe nail infections may seem chronic and resistant to therapy due to:	1. Footgear occlusion
	2. Nail trauma
	3. Decreased circulation
	4. Endogenous re-infection

Other Fungal Infections

Candidiasis	candida albicans is a yeast fungus
	Clinical manifestations: Intertrigo, OM, tinea pedis, folliculitis, paronychia
Candidal Paronychia	Treatment for 4-6 weeks w/ topical imidazoles, nystatin, ciclopirox or terbinafine
Tinea Versicolour	Caused by Malassezia furfur (yeast)
	characterized by hypopigmented and/or hyperpigmented macules w/ a fine scale localized to the trunk and thighs

Other Fungal Infections (cont)

Usually found in lipic rich areas and releases an acid that impacts melanin

Tx: topical azole cream/shampoo, terbinafine gel, selenium sulfide,cicloppirox

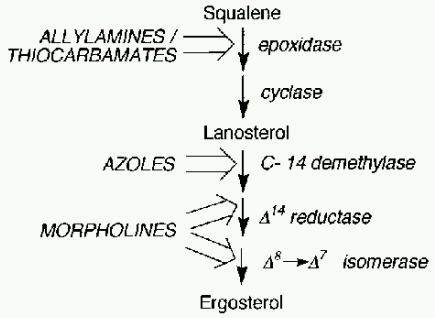
Oral Tx: fluconazole, itraconazole. Oral terbinafine is not effective

PREVENTION

1. Keep skin intact (protected)	2. Prevent excessive moisture- don't let skin get excessively wet, change socks and wet shoes. Dry thoroughly after shower

3. Avoid contamination- wear shower shoes. Put socks on first, disinfect shoes and bathtub

Inhibitors of the Ergosterol Synthesis Pathway



Allylamines

MOA:	Inhibit squalene epoxidase and prevents formation of lanosterol from squalene. lanosterol is needed for production of ergosterol which is needed for normal structure and function of plasma membrane. Accumulation of squalene which is a toxic metabolite will occur, making these drugs fungicidal

Allylamines (cont)

Oral Terbinafine	Hepatic CYP metabolism, renal excretion (inactive). Highly lipid soluble so penetrates through nails. However, benefits do not outweigh risk for tx of OM.
	Pulse dosing is effective as it is less overall drug so better on liver and less costly
Topical Terbinafine:	1% cream or gel or 1% spray, mitte: 15g or 30g, tube or 30ml for spray sig: apply to affected areas of skin on feet once or twice a day
	Uses: tinea pedis (dematophytes), tinea corporis, tinea cruris
Oral Terbinafine:	Daily dosing: 250mg tablets mitte: 84 tablets sig: one tablet po daily for 12 weeks (LFT and CBC baseline lab tests with repeat at 4-6 weeks)
	Pulse dosing: 250mg tablets, mitter: 42 tablets sig: two tables po daily for 1 week followed by 3 weeks off for three months then mitte 7 tablets sig: one tablet po daily for 7-21 days
	Uses: OM, tinea pedis(dermatophytes)/capitis/cruris/corporis, and systemic fungal and candida infections

Allylamines (cont)

	Contraindicated in pts with liver disease or renal impairment
	side effects: Hepatotoxicity, neutropenia, GI upset, skin reactions, taste/smell disturbances, renal and liver function impairment
Allylamine Hepatotoxicity:	increase in serum transaminase levels, symptomatic liver injury occurs rarely, majority of cases resolve within 3-6mos of stopping meds
Allylamine Interactions	warfarin and other CYP metabolism drugs, cimetidine, azole antifungals, TCAs, SSRI, beta blockers, opioids, MAO inhibitors, anti-arrythmics (ie digoxin),

Types of Onychomycosis

1. Distal Subungal Onychomycosis	Most common OM and most common organism is T.rubrum
	Fungal penetrates distal hyponychium or lateral nail fold region
	Starts with subungual debris, yellowing and onycholysis

Types of Onychomycosis (cont)

	After many years, keratinization of the distal nail bed occurs with loss of the nail grooves. Proximal nail plate then appears as a thick mound w/ neglected care, a ram's horn deformity develops
	non dermatophytes such as aspergillus niger can also cause OM (ddx is pseudomonas infection)
2. Proximal Subungual Onychomycosis	Occurs secondary to fungi entering the proximal nail fold and then the matrix and nail plate.
	infection involves the nail plate but the nail surface is intact
	Debris develops under nail plate then onycholysis. Nail appears white and fluid may accumulate under nail
3. White Superficial Onychomyocosis	Due to T.mentagrophytes
	Fungi infect the superficial nail plate. Nails are dry, soft, powdery white
	Topical may work early on as it is on the nail plate
4. Candidal Onychomycosis	Caused by candida albicans

Types of Onychomycosis (cont)

	Nails are thick, white-yellow or yellow-brown
	entire nail plate is involved often with paronychia, inflammation and toe tip vesiculation
Complications	Permanent nal matrix or nail bed changes, subungual ulceration, secondary bacterial infection, possibly gangrene

Azoles

MOA:	Inhibit 14a-sterol demethylase and prevent formation of ergosterol by preventing lanosterol conversion to ergosterol. Fungistatic
Clotrimazole (Topical)	1% cream mitte: 15g or 30g tubes or 500g tub sig: apply to affected areas on feet twice a day for four weeks.
	Uses: superficial fungal and candida infections of stratum corneum and squamous mucosa (not good for hair and nails)
Miconazole(Topical)	2% cream or 2% spray mitte: 30g tube or 85g cans for spray sig: apple to affected areas twice a day for four weeks
	uses: same as clotrimazole

Azoles (cont)	
Ketoco-nazole(Topical)	2% cream mitte: 30g tube sig: apply to affected areas once-twice a day for 4 weeks.
	uses: same as above
Efinaconazole (Jublia) (Topical)	10% cream, applied daily to nails with no need to remove excess product
	uses: DLSO, AE: dermatitis and vesicles on application sites
	Gold standard for topical tx of OM

-Azoles inhibit hepatic P450 enzymes therefore drug to drug interactions are an important consideration whenever they are used.
-Topical azoles are better for candida infections and are less expensive whereas allylamines are better against common dermatophytes but are more expensive

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