

Summary: Infections in Diabetic Patients

- Diabetes is **common** in Saudi Arabia. **Controlling** diabetes is more important than its treatment.
- Diabetics are **more susceptible** to infections due to both **host-related** and **organism-specific** factors.

1. Host-Related Factors

Vascular insufficiency | Sensory peripheral neuropathy | Hyperglycemia & metabolic derangements | Surgical site infections
Autonomic neuropathy: predisposes UTIs | Increased Skin and Mucosal Colonization: *S.aureus*, *C. albicans* |
Immune defects: (Depressed Neutrophil function, Affected adherence to the endothelium, Decreased chemotaxis and phagocytosis, Compromised intracellular bactericidal activity. Depressed cell mediated immunity.)

2. Organism-Specific Factors

Candida Species	Rhizopus Species
<ul style="list-style-type: none"> • Hyperglycemia induces <i>Candida Albicans</i>. • It is common in: <p>Diabetic patients, Pregnant ladies, Immunocompromised patients</p>	<ul style="list-style-type: none"> • <i>Rhizopus</i> is a fungi found in the environment as spores. • <i>Rhizopus</i> is the second most severe infection after Necrotising Fasciitis.

Common infections in diabetic patients:

Upper Respiratory Tract Infections

<p>Invasive (Malignant) Otitis Media (life-threatening) :</p> <ul style="list-style-type: none"> • Caused by: <i>Pseudomonas Aeruginosa</i> • Clinically: Severe pain, otorrhea, hearing loss, intense cellulitis and edema of the ear canal. • Treatment: Surgical debridement. + IV anti-pseudomonas antibiotics • Diagnosis: CT or MRI for bone destruction. 	<p>Rhinocerebral Mucormycosis (life-threatening fungal infection)</p> <ul style="list-style-type: none"> • Caused by: <i>Rhizopus</i>, <i>Absidia</i> and <i>Mucor</i> species • Risk factor: Diabetic Ketoacidosis (they have very severe infection) • Treatment: Surgical debridement + Prolonged IV Amphotericin B. • Diagnosis: Biopsy of the necrotic tissue + Direct smear examination for hyphae.
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Lower Respiratory Tract Infections

Pneumonia and Influenza:

- Caused by: **Gram positive bacteria: *Staphylococcus Aureus* and *Streptococcus Pneumoniae* | Gram negative bacteria: *Enterobacteria* and *Legionella* | Other organisms: *Influenza Virus* and *Mycobacterium Tuberculosis*.**
- **Prevention:** Routine **pneumococcal** and **influenza vaccination**

Abdominal Infections

Severe Fulminating Cholecystitis

- Caused by: ***Enteric Gram Negative Bacteria* and *Anaerobes***.
- Treatment: **Cholecystectomy** + Broad spectrum antibiotics.

Genitourinary Infections

<p>Asymptomatic Bacteriuria > 10⁵ bacteria/ml urine (common)</p> <ul style="list-style-type: none"> • Prevention: Screening is indicated for diabetic patients to treat asymptomatic bacteriuria. Sometime they will present with urosepsis and complication of shock (septic shock) because of the UTI. 	<p>Cystitis</p> <ul style="list-style-type: none"> • Clinical: High incidence of unsuspected upper UTI. • Caused by: Gram positive: <i>Group B Streptococcus (Streptococcus Agalactiae)</i> Gram negative: <i>Escherichia Coli</i> Fungal: <i>Candida Albicans</i> 	<p>Pyelonephritis (Kidney infection)</p> <ul style="list-style-type: none"> • Types: 1. Bilateral: Diabetes predisposes to a more severe infection of the upper urinary tract. 2. Emphysematous: Carries grave prognosis (30% fatal). (don't ignore lower UTI)
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Skin and Soft Tissue Infections

Necrotizing Fasciitis and Myositis:

- Caused by: can be caused by **anything** like:
(Group A Streptococcus), S.Aureus, CA-MRSA, Clostridium Fragilis (Gas producing gram positive bacilli), Anaerobes.
- Two types of necrotizing fasciitis:
Type1: is caused by **multiple organism flora**
Type2: is one organism only which is **Group A Streptococcus**.
- Clinically: **Very severe pain**, Crepitus, Soft tissue gas seen in radiograph or CT scan.
- Treatment: **Aggressive surgical debridement + IV antibiotics. (BOTH)**

Diabetic Foot :

- The **most common** and most **important** soft tissue infection in diabetic patients.
- Peripheral neuropathy**
- Compromised microvascular circulation. Can lead to **amputation** and **death**
- Complicated by:
 - Chronic Osteomyelitis.**
 - Gas Gangrene** (due to **Clostridium Perfringens**)
- Pathogenesis: Compromised local blood supply predisposing foot to infection.
- Diagnosis:**
 - Vascular** and **neurological** state examination.
 - CT, MRI, or Gallium scan
 - Exploration of ulcer
 - Deep specimens (tissues)** for culture and susceptibility testing.
- Treatment:

Mild case: Debridement of necrotic tissue + **Antibiotic according to the causative bacteria**

Moderate to sever case: Hospitalization + IV antibiotics + Possible surgery (amputation).

Cellulitis:

- Caused by:
 - Beta-hemolytic streptococci (Group A or B)*, S.Aureus, Enterobacteriaceae - in chronic ulcers.
- Clinically:
 - Tender, erythematous, non-raised skin lesion on the lower limb, may be accompanied with lymphangitis (which suggests *Group A Streptococcus*).
 - Bullae Suggests *Staphylococcus Aureus* and occasionally *Group A Streptococcus*.

Macerated ulcer or nail injury (sinus):

- Caused by: *Pseudomonas Aeruginosa*

Bone infections

Chronic Osteomyelitis

- Risk factors: Grossly visible bone or ability to **probe to bone**.
- Caused by: *Group A and B Streptococcus*, *Staphylococcus Aureus*, *Enterobacteriaceae*, *Bacteroides Fragilis*.
- Patients is diabetic presented with ulcer **WHAT IS THE BEST SAMPLE TO COLLECT? TISSUE SAMPLE**
- Do **not** use swab!

Acute Osteomyelitis

- Risk factors: Grossly visible bone or ability to **probe to bone**.
- Pain at the involved bone.
- Fever.
- Adenopathy.

Treatment & prevention: *Same as diabetic foot*. + if bone is involved it is **serious**; you have to treat for 6 weeks and if it is superficial treatment is for 10 - 14 days.

Candidiasis

- The **most common** invasive **fungal** infections in immunocompromised patients (**opportunistic** infection)
- It is 4th most common cause of nosocomial bloodstream infection** (candidemia)

2. Mucous membrane infections

Oral thrush (oropharyngeal)	Esophagitis	Vaginitis (vulvovaginitis)
<ul style="list-style-type: none"> White/grey pseudomembranous patches on oral surfaces "especially tongue" with underlying erythema Common in neonates, infants, elderly immunocompromised host (AIDS / broad spectrum antibiotics) 	Complicated oral thrush "in AIDS usually"	<ul style="list-style-type: none"> Common in pregnancy, diabetics, use of contraceptives. Thick discharge, itching irritation. White patches on vaginal mucosa

3. Cutaneous infections

Intertriginous candidiasis	Nail infections	Chronic mucotaneous candidiasis
<ul style="list-style-type: none"> Infections of skin folds eg. Axilla, buttock, 	<ul style="list-style-type: none"> Onychomycosis → nails 	<ul style="list-style-type: none"> Immune disorder of T cells.

toe web, under breast. • Erythematous lesion, dry or moist or whitish accompanied by itching and burning.	• Paronychia → skin around nail bed	• It is characterized by chronic infection limited to mucosal surfaces, skin, & nails • It is common in children
Diaper rash		

3. Urinary tract infection (signs & symptoms should be present + the number should be significant)	
4. Candidemia <u>Causes:</u> <ul style="list-style-type: none"> • Increased colonization (endogenous / exogenous) • Damage in host barriers by catheters, trauma, surgery • Immunosuppression • Central venous catheters (CVC) - Fever could be the only clinical manifestation - It can lead to disseminated candidiasis → Septic shock / Meningitis / Ocular involvement (retinitis)	5. Disseminated (systemic, invasive) infection <u>EXAMPLE: Pulmonary Candidiasis</u> <ul style="list-style-type: none"> • 1ry pneumonia is less common and could be a result of Aspiration (comatose patients) • 2ry pneumonia commonly seen with hematogenous candidiasis (Immunocompromised patients) “= disseminated infection” • Isolation of candida from sputum, bronchoalveolar lavage is not always significant. So you have to see the clinical features, radiology & other lab investigations.

◀ Laboratory diagnosis

<ol style="list-style-type: none"> 1. <u>Direct microscopy</u>: Budding yeast cells and pseudohyphae 2. <u>Culture</u>: <ul style="list-style-type: none"> • <u>Candida albicans</u>: In SDA / blood agar → creamy moist colonies • <u>Other species</u>: In chromagar “each yeast has a certain color” 3. <u>Blood culture</u>: Used if septicemia is suspected 4. <u>Serology (serum)</u>: Test for Antigen using ELISA / Test for Antibodies 5. <u>PCR</u> 	Candida albicans vs. other candida species <u>The following tests are used to identify C. albicans:</u> (1) Germ tube formation (2) Chlamydospore production (3) Resistance to 500 µg/ml Cycloheximide <u>If negative, how can we specify which species?</u> (1) Carbohydrate assimilations & fermentation (2) chromagar
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◀ Treatment

<u>Antifungal susceptibility is done in the following cases:</u> (1) sterile samples (CSF/blood) (2) no response to treatment (3) recurrent infections	<u>Fluconazole is not given in case of:</u> C. glabrata & C. krusei infection
<u>In candidemia:</u> treat for 14 days after the last negative culture & resolution of signs & symptoms + remove catheters (if possible)	