Infections in Diabetic Patients

MICROBIOLOGY 434

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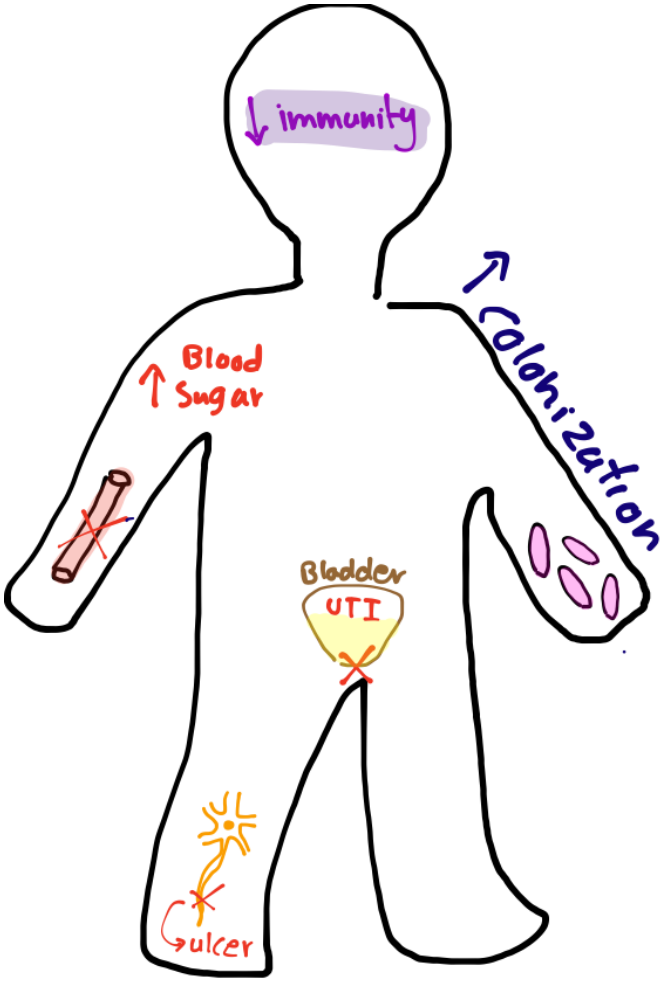
Introduction:

- Diabetic patients are more susceptible to predispose to infections. "Unlike non diabetic patients"
- **Nearly half** of all diabetic patients had at least one hospitalization or outpatient visit for infections compared to non-diabetic patients.
- Infections may **increase** the morbidity and mortality in diabetic patients.

Why diabetic patients are at increased risk to have infections? 1- Host related 2- organism related

Host Related Factors

- **Vascular insufficiency:** result in local tissue ischemia:
  - enhances the growth of microaerophilic and anaerobic organisms.
  - depress the O2 dependent bactericidal functions of leukocytes.
  - impairment of the local inflammatory response
  - impairment absorption of antibiotics.

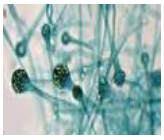


- **Sensory peripheral neuropathy:**
  - Minor local trauma → skin ulcers → diabetic foot infections.
- **Autonomic neuropathy:**
  - Diabetic patients may develop urinary retention and stasis → predisposes to develop UTIs.
- **Hyperglycemia and metabolic derangements in diabetes**
  → facilitate infection.
- **Immune defects in diabetes such as:**
  - ↓ Neutrophil function
  - Affected adherence to the endothelium.
  - Affected chemotaxis and phagocytosis
  - Compromised bactericidal activity.
  - ↓ cell mediated immunity → more prone to viral infection
- **Increased skin and mucosal colonization:**
  - Diabetics on insulin have asymptomatic nasal and skin colonization with S.aureus [MRSA]
  - Colonization predisposes to skin infection and transient bacteremia which may result in distal sites infection such as damaged muscle
  - In type- 2 diabetes → mucosal colonization with C.albiacns [vaginitis] is common.
  - Vulvovaginitis caused by non-albicans Candida spp is common in patients [females] with poor glycemic control
- **Surgical site infections :** associated with postoperative hyperglycemia which is related to deleterious effect on chemotaxis, phagocytosis and adherence of granulocytes.

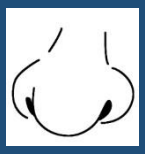
Organism Specific Factors Fungal → rare in immune competent people

- **Candida albicans:**
  Glucose inducible proteins promote adhesion of C.albicans to buccal or vaginal epithelium → impairs phagocytosis, giving the organism advantage over the host.

- **Rhizopus spp:** "Not common but it is very severe and more series that's why it is important"
  Ketoacidosis allow Rhizopus spp. which cause Mucormycosis (Zygomycosis) to thrive in high glucose acidic conditions .



Common infections in diabetic patients:

	Invasive (malignant) otitis media uncommon but potentially life threatening	Rhinocerebral Mucormycosis A life threatening fungal infection
Upper Respiratory Tract Infections 	**Cause:** P.aeruginosa an opportunistic infection **MOA:** Slowly invades from the external canal of the ear into adjacent soft tissues, mastoid and temporal bone → eventually spreads across the base of the skull **Signs/Symptoms:** severe pain – otorrhea [ear discharge] – hearing loss – intense cellulitis – edema of ear canal **Diagnosis:** CT & MRI to see the extent of bone distruction **Treatment:** Surgical debridement & IV anti-pseudomonas antibiotics [pepracillin – tazobactam – ceftazidine] .	**Cause:** (Mucormycosis) → Rhizopus - Absidia and Mucor species. **Clinically:** facial or ocular pain - nasal stuffiness - generalized malaise - fever. [intranasal black eschars or necrotic turbinate] **Diagnosis:** biopsy of the necrotic tissue. **Treatment:** surgical debridement and prolonged IV therapy with Amphotericin B .
Lower respiratory tract infections [Pneumonia and Influenza] 	**Diabetic patients are 4 times more likely to die from pneumonia or influenza than non-diabetic patients → Routine pneumococcal and influenza vaccination recommended.** yearly **Common organisms:** • **Gram positive bacteria :** S.aureus \ S.pneumoniae. • **Gram negative bacteria:** Enterobacteria \ Legionella. Seen in the ICU • **Other organisms:** Influenza virus [A – B] \ Mycobacterium tuberculosis	
Abdominal infections [Severe fulminating Cholecystitis] 	**Common causes:** • enteric Gram negative bacteria • anaerobes • Gall stone or Peritonitis may be present • Gas gangrene and perforation may occur. **Management:** Cholecystectomy and broad spectrum antibiotics. [Diabetic are olso prone to get periodontal infection عدوى الفم و اللثة]	

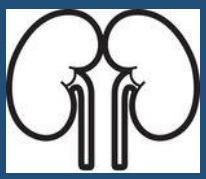
Genitourinary infections

Vulvovaginitis

Asymptomatic bacteriuria

Cystitis

Pyelonephritis



Asymptomatic bacteriuria	Cystitis [bladder]	Pyelonephritis [kidney]
• **(> 10^5 bacteria/ml urine) is common. But the patient is asymptomatic** DM patients should do urine tests frequently • **Screening** is indicated for diabetic patients to treat asymptomatic bateriuria • Symptoms/ Signs and time of onset similar to non-diabetics	**Cause:** • same as non-diabetics, **incomplete bladder emptying** and high incidence of unsuspected upper UTI. • **Bacteria** ○ **Gram negative rods** [e-coli most common] ○ group **B** streptococci [other name : agalacti] • **fungi** ○ Candida albicans	**Bilateral Pyelonephritis:** diabetes predisposes to a more severe infection of the upper urinary tract **Emphysematous Pyelonephritis:** • exclusively an infection of diabetics **(60%)** • carries grave prognosis **(30% fatal).**

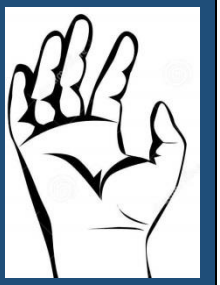
Diagnosis:

- flank mass & crepitus
- CT scan shows gas in the renal tissues.

Management: supportive & IV antibiotics , nephrectomy may be needed.

Skin and soft tissue infections

Most important



Risk factors in diabetic patients :

- Sensory neuropathy → no pain perception.
- Atherosclerotic vascular disease
- Hyperglycemia: **>250 mg/ dl**
- **History of:** [cellulitis - peripheral vascular diseases - Tinea infection - dry skin]

Organisms:

- **Streptococcus pyogenes (Group A Streptococcus → GAS)**
- **S.aureus**
- **CA-MRSA (community acquired - MRSA) → 77%** of skin\soft tissue infections
- **Anarobes → clostridium fecalis**

Necrotizing fasciitis آكلة لحوم البشر

Defenition: a deep –seated ,life threatening infection of subcutaneous tissue with progressive destruction of fascia, fat and muscles.

Causes: 10% associated with **Group A Stept** ,with or without **S.aureus**, **anaerobes** may be involved - Gram positive bacilli →clostridium fragilis

Clinically:

- pain of proportion of skin
- anasthesia of overlying skin.
- **Violaceous** [violet] discoloration of skin that evolves into **vesicles and bullae**
- Crepitus a grating sound or sensation produced by friction between bone and cartilage or the fractured parts of a bone
- soft tissue **gas** seen in radiograph or CT scan.

Management: aggressive surgical debridement & IV antibiotics.

Diabetic foot infection

The most common and most important soft tissue infection in diabetic patients, why ?

- **because it is related to :**
  - **peripheral neuropathy** → may lead to incidental trauma that goes unrecognized
  - **compromised microvascular circulation** which limits the access of phagocytic cells to the infected
  - poor concentration of antibiotics in the affected area.

Complicated by:

- **chronic Osteomyelitis**
- **gas gangrene**
- **amputation and death.**

The spectrum of foot infection ranges from: superficial cellulitis to chronic Osteomyelitis**.**

[infection may be involving bone or soft tissue or both - Sinus tract may be present]

Pathophysiology:

- **microvascualr disease limits blood supply to the superficial and deep structures.**
- **Pressure from ill-fitting shoes**
- **Trauma**

→ **Compromises local blood supply predisposing foot to infection**

Diagnosis:

- Vascular and neurological sate examination
- Radiology: [**doppler ultrasonography - transcutaneous oxymetery - MR angiography**]
- **CT – MRI – Gallium scan** → for soft tissue and bone
- Exploration of ulcer to determine its depth and the presence of sinus tract
- **Deep specimens (tissues) for culture and susceptibility testing.**

Cellulitis

Organism:

- beta-hemolytic streptococci
  [Group A or B]
- S.aureus
- Entertobacteriacae in chronic ulcers.
  [E.coli, Klebsiella, **Proteus** spp]

Clinical:

- tender, erythematous non-raised skin lesion on the lower limb, may be accompanied with **lymphangitis** which → **suggests Group A Strept**
- **Bullae** → **suggests S.aureus** & occasionally Group A Strept

Deep soft tissue infections

necrotizing fasciitis, or myositis

Organism:

- Group A Strept
- gas producing **gram positive bacilli** → **Clostridium**

Clinical:

- patient acutely ill, with painful induration of the limb especially the **thigh**
- Foot may be involved.

Wound discharge suggest anaerobes

Macerated ulcer or nail injury

- **sinus**
- **P.aeruginosa**

Osteomyelitis

- **Factors that increases its development:**
  - **Grossly visible bone or ability to probe to bone**
  - **ESR > 70 mm/h**
  - size >2x2 cm - depth > 3mm - longer than 1-2 w

Chronic Osteomyelitis:

- **Organism:**
  - Group A – B strept
  - Entertobacteriacae [E.coli ,Proteus mirabilis , K.pneumoniae]
  - Bacteroides fragilis

- **Clinical:**
  - fever
  - foul discharge
  - maybe pain
  - no lymphangitis,
  - deep penetrating ulcer and sinuses on the planter surface of the foot.

NZB

Acute Osteomyelitis:

- pain at the involved bone
- fever
- adenopathy.

Management and treatment:

- Control blood sugar and hydration
- Evaluation of neuropathy and vasculopathy

- **Mild cases:**
  - debridement of necrotic tissues
  - use of antibiotics according to the causative bacteria
    Cloxacillin, Cephradine, Clindamycin , TMP-SMX (for CA-MRSA), Aminoglycosides, Quinolones.

- **Moderate to severe cases :** → places the foot at risk of amputation
  - Needs hospitalization ,IV antibiotics and surgical intervention if needed.

Prevention: [corner stone of diabetic foot care]

- **It is multidisciplinary** including family physician, social worker, home care nurse and specialist.
- **Patient education** about the control and complication of diabetes.
- **Blood sugar** should be controlled promptly (shift to insulin if oral hypoglycemic agents were not effective),weight reduction, a diet low in fat and cholesterol.
- **Proper foot care**, using protective footwear and pressure reduction.
- Self and family member **examination of foot**

MCQs:

1-A 36-year-old man with a long history of diabetes mellitus. he was admitted to the hospital for treatment of an ulcer, which had present on his left great toe for several months. Because of inability of multiple oral antibiotic courses to resolve the ulcer, he underwent amputation. His amputation stump was mottled with many areas of purplish discoloration. Crepitus was there too, an x-ray of affected area showed gas in the soft tissues. A gram stain of a swab from the necrotic tissue showed many large gram positive bacilli and numerous polymorphs. Based on morphology of the gram-positive organisms, their most likely identification is:

A-Streptococcus pyogens B-Escherichia Coli C- Stahphylococcus aureus D-Clostridium Perfringens

ANS: D

An isolate from a wound culture is a gram negative rod identified as Bacteroides Fragilis. Aneaerobic infection with B.fragilis is characterized by:

A-A foul smelling discharge B-A black exudate in the wound

C-An exquisite susceptibility to penicillin D-A heme-pigmented colony formation

Ans: A

3-staphaylococcus aureus causes a wide variety of infections, ranging from wound infections to pneumonia. Treatment of S.aureus infection with penicillin is often complicated by the:

A-Inability of penicillin to penetrate the membrane of S.aureua

B-Production of penicillinase by S.aureus

C-Production of penicillin acetylase by S.aureus

D-Lack of penicillin binding sites on S.aureus

E-Allergic reaction caused by staphylococcal protein

ANS:B

4-Recentely there have been sensational media reports of patients infected with invasive, "flesh eating" bacteria that spread rapidly through the tissue. This necrotizing fasciitis is usually caused by:

A-Staphylococcus aureus B-Group A streptococci C-Micrococcus

D-Bacillus cereus E-Clostridium tetani

ANS:B

5-The antibiotic of choice for pseudomonas aeroginosa infection is:

A-Erythromycin B-Ampicillin C-Ceftriaxone D-TMP/SMX E-Piperacillin

ANS:E

6-The antibiotic therapy of choice for Legionellosis is:

A-Penicillin B-Ampicillin C-Erythromycin D-Vancomycin E-Ceftriaxone

ANS:C