Infections in Diabetic Patients

Prof. Hanan Habib & Prof. Ali Somily

Department of Pathology & Laboratory Medicine- Microbiology section

College of Medicine, KSU

OBJECTIVES

- To identify the risk factors to develop infection in diabetic patients.
- To recognize common infections in diabetic patients ***(with emphasis on diabetic foot infection***).
- To be familiar with the causative organisms and pathogenesis of common infections .
- To know the clinical presentations of common infections.
- To specify the laboratory and radiological tests of common infections
- To recognize the common complications of diabetes mellitus (***diabetic foot***).
- To be aware about the management and antimicrobial therapy of common infections in diabetic patients.

Introduction

- Diabetic patients are predisposed to infections
- 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?**

Because of Host related factors & Organisms related factors:

Host Related Factors

- **Vascular insufficiency** result in local tissue ischemia that
  - Enhances the growth of microaerophilic and anaerobic organisms
  - Depressing the O2 dependent bactericidal functions of leukocytes.
  - Impairment of the local inflammatory response
  - Affect absorption of antibiotics.
- **Sensory peripheral neuropathy**. Minor local trauma may result in skin ulcers, which leads to diabetic foot infections.
- **Autonomic neuropathy**: Diabetic patients may develop urinary retention and stasis that ,in turn, predisposes to develop UTIs.

Host Related Factors

- **Hyperglycemia and metabolic derangements** in diabetes may facilitate infection.
- **Immune defects** in diabetes such as:

- Depressed Neutrophil function
- Affected adherence to the endothelium.
- Affected chemotaxis and phagocytosis
- Compromised bactericidal activity.
- Depressed cell mediated immunity

Host Related Factors

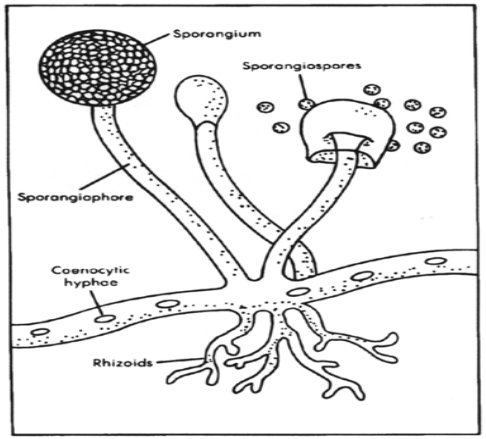
- **Increased skin and mucosal colonization**
- Diabetics on insulin
  - Have asymptomatic nasal and skin colonization with *S.aureus* ,particularly MRSA.
  - Colonization predisposes to skin infection and transient bacteraemia which may result in distal sites infection such as damaged muscle.
- In type- 2 diabetes ;
  - Mucosal colonization with *C.albiacns* is common.
  - **Vulvovaginitis** caused by non-*albicans Candida* spp. is common in patients with poor glycemic control.

Host Related Factors

- **Surgical site infections** associated with postoperative hyperglycemia which is related to deleterious effect on chemotaxis, phagocytosis and adherence of granulocytes

Organism Specific Factors

- ***Candida albicans*** –glucose inducible proteins promote adhesion of *C.albicans* to buccal or vaginal epithelium which in turn, impairs phagocytosis, giving the organism advantage over the host.
- ***Rhizopus* spp.**-ketoacidosis allow *Rhizopus* spp. which cause **Mucormycosis** (Zygomycosis) to thrive in high glucose acidic conditions .



Common infections in diabetic patients

- Upper & lower respiratory tract infections
- Periodontal infections
- Genitourinary infections
- Abdominal infections
- Skin and soft tissue infections & diabetic foot

Upper Respiratory Tract Infections

- Invasive (malignant) ottitis media, uncommon but potentially life threatening.
- Rhinocerebral mucormycosis

Invasive otitis externa (malignant, necrotizing)

Cause: *P.aeruginosa*.

Slowly invades from the external canal into adjacent soft tissues, mastoid and temporal bone and eventually spreads across the base of the skull.

Symptoms and Signs:Patient present with severe pain, otorrhea, and hearing loss.

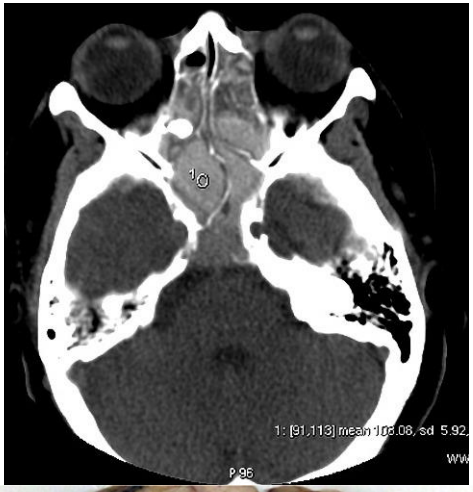
Intense cellulitis and edema of the ear canal.

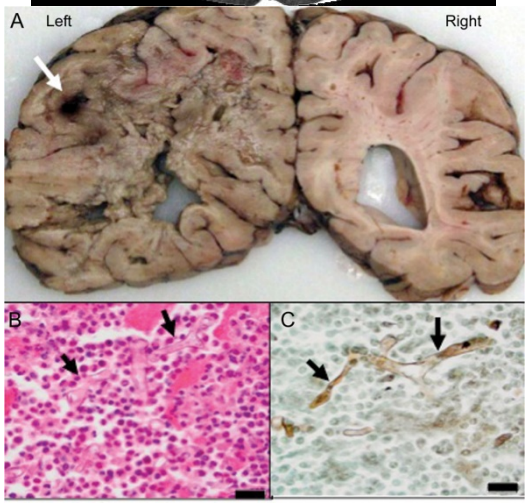
Diagnosis: CT and MRI studies to define the extent of bone destruction.

Treatment: surgical debridement & IV anti-pseudomonas antibiotics.

Rhinocerebral Mucormycosis

- A life threatening fungal infection
- **Cause**: (Mucormycosis)*Rhizopus, Absidia* and *Mucor* species.
- **Clinically**: facial or ocular pain and nasal stuffiness, generalized malaise and fever. May be intranasal black eschars or necrotic turbinates.
- **Diagnosis**: biopsy of necrotic tissue
- **Treatment:** surgical debridement and prolonged IV therapy with Amphotericin B .

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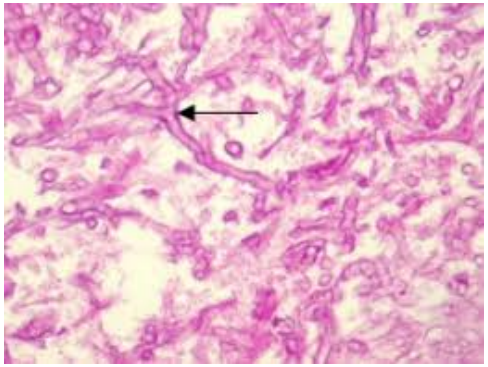


Lower respiratory tract infections pneumonia and influenza

- Diabetic patients are 4 times more likely to die from pneumonia or influenza than non-diabetic patients.
- **Common organisms**:
  - Gram positive bacteria :*S.aureus* , *S.pneumoniae.*
  - Gram negative bacteria: Enterobacteria and *Legionella*.
  - Other organisms: Influenza virus & *Mycobacterium tuberculosis* .

- **Routine pneumococcal vaccination and influenza recommended.**

Genitourinary infections

- **Asymptomatic bacteriuria** (> 100,000 /ml urine) is common.

Symptoms/ Signs and time of onset similar to non-diabetics.

Diabetes is not an indication for screening for treating asymptomatic bacteriuria.

- **Cystitis**: same as non-diabetics, incomplete bladder emptying and high incidence of unsuspected upper UTI.

Bacteria (Gram negative rods or group B streptococci) or fungi (*Candida albicans*) may be involved.

- **Bilateral Pyelonephritis**: diabetes predisposes to a more severe infection of the upper urinary tract.
  Emphysematous Pyelonephritis exclusively an infection of diabetics (60%) and carries grave prognosis (30% fatal).

Diagnosis: flank mass & crepitus . CT show gas in the renal tissues.

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

- **Vulvovaginitis :** as mentioned earlier.

Abdominal infections

- **Severe fulminating Cholecystitis**

Common causes:

Enteric Gram negative bacteria and anaerobes.

Gall stone or peritonitis may be present.

Gas gangrene and perforation may occur.

Management:

Cholecystectomy and broad spectrum antibiotics

Skin and soft tissue infections

- **Risk factors in diabetic patients :**

- Sensory neuropathy: no pain perception.
- Atherosclerotic vascular disease
- Hyperglycemia : >250 mg/ dl increased risk
- H/O of cellulitis, peripheral vascular diseases, *Tinea*, and dry skin.

- Organisms: *Streptococcus pyogenes* (Group *A Streptococcus* (GAS)) and *S.aureus*

CA-MRSA (community acquired -MRSA) is of concern causes (77%) of skin and soft tissue infections .

- **Necrotizing fasciitis** :a deep –seated ,life threatening infection of subcutaneous tissue with progressive destruction of fascia, fat and muscle.

Causes :Typically cause by GAS

Other causes *S.aureus*, anaerobes may be involved.

Clinically: pain of proportion of skin, anaesthesia of overlying skin. *Violaceous discoloration* of skin that evolves into vesicles and bullae, crepitus ,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 and compromised microvascular circulation which limits the access of phagocytic cells to the infected area and 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.
- Combined infection involving bone and soft tissue may occur
- Skin, soft tissue or bone or all
- Sinus tract may be present

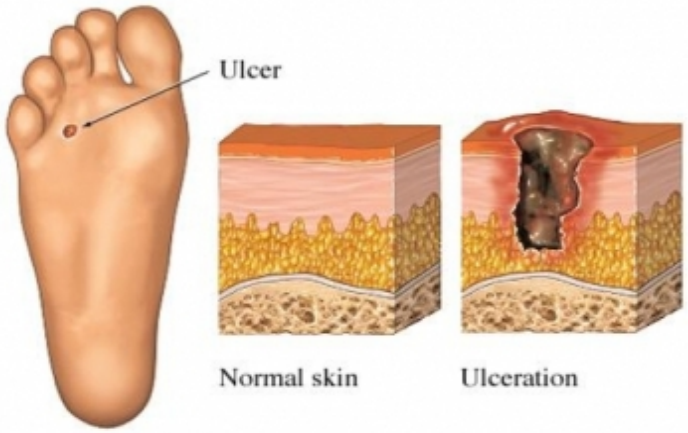
- **Pathophysiology**:
- Diabetic neuropathy may lead to incidental trauma that goes unrecognized.
- microvascualr disease limits blood supply to the superficial and deep structures. Pressure from ill fitting shoes ,trauma compromises local blood supply predisposing foot to infection.

Organisms involved in diabetic foot infections

- **Cellulitis**: : beta-hemolytic streotococci (group A,B streptococi), *S.aureus*, *Entertobacteriacae* (*E.coli*, *Klebsiella, Proteus spp.*) in chronic ulcers.
- **Macerated ulcer or nail injury** (sinus) : *P.aeruginosa* .
- **Deep soft tissue infections (**necrotizing fasciitis, or myositis).GAS & gas producing gram positive bacilli (*Clostridium*).
- **Chronic Osteomyelitis**: GAS and Group B Sterptococcus, *S.aureus, Enterobacteriacae* (*E.coli* ,*Proteus mirabilis* , *K.pneumoniae.) & Bacteroides fragilis*

Factors that increases the development of Osteomyelitis:

grossly visible bone or ability to probe to bone, ulcer size >2x2 cm, ulcer depth > 3mm, ulcer duration longer than 1-2 wks, ESR >70 mm/hr



Clinical presentations of diabetic foot infections

- **Cellulitis**: tender, erythematous non-raised skin lesion on the lower limb ,may be accompanied with lymphangitis which suggests GAS.
- Bullae suggests *S.aureus* ,occasionally GAS.
- **Deep skin and soft tissue infections**: patient acutely ill, with painful induration of the limb especially the thigh . Foot may be involved.

Wound discharge suggest anaerobes

- **Acute Osteomyelitis**: pain at the involved bone, fever, adenopathy.
- **Chronic Osteomyelitis**: fever ,foul discharge , may be pain, no lymphangitis, deep penetrating ulcer ,and sinuses on the planter surface of the foot

Diagnosis of foot infections

- Thorough examination to evaluate the patient's vascular and neurological status.
- Radiological examination including doppler ultrasonography ,transcutaneous oxymetery, MR angiography.
- CT scan ,MRI and gallium -67 scan for soft tissue and bone evaluation.
- Exploration of ulcer to determine its depth and presence of sinus tract.
- Deep specimens (tissues) for culture and susceptibility testing

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Management & Treatment

- Control blood sugar and hydration
- Evaluation of neuropathy and vasculopathy
- Mild cases: debridement of necrotic tissues and use of antibiotics according to the causative bacteria eg. 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

- is the cornerstone 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.