Lecture 1

Infections in diabetic patients

- Additional Notes
- Important
- Explanation
- Examples

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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.
- Diabetic patients are at increased risk to have infections because of Host related factors & Organisms related factors. (will be discussed in next slide)
- Common infections in DM patients:
  - ✓Upper & lower respiratory tract infections
  - ✓Periodontal infections
  - ✓Genitourinary infections
  - ✓Abdominal infections
  - ✓Skin and soft tissue infections & diabetic foot
- Most common cause of primary bacteremia comes from endocrine

- Host related factors:
  - ✓ **Vascular insufficiency** result in local tissue ischemia that enhances the growth of microarophilic and anaerobic organisms while depressing the O2 dependent bactericidal functions of leukocytes. There may be also impairment of the local inflammatory response and 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.
  - ✓ **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
- 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 .

- Upper respiratory tract infection:

  There are 2 types for URTI common in diabetic patients

  ✓Invasive ottitis Externa

  - **Cause:** P.aeruginosa[1]. Slowly invades from the external canal into adjacent soft tissues, mastoid and temporal bone and eventually spreads across the base of the skull.
  - **Symptoms & signs:** Patient present with severe pain, otorrhea, and hearing loss, Intense cellulitis[2] and oedema of the ear canal.
  - **Diagnosis:** CT and MRI studies to define the extent of bone destruction.
  - **Treatment:** surgical debridement & IV anti-pseudomonas antibiotics.

  ✓Rhinicerebral 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

1: P.aeruginosa: gram negative and oxidative positive
2: cellulitis: infection of skin (specifically fat in dermis and subcutanous)

- Lower respiratory tract infection:
  - ✓ Diabetic patients are 4 times more likely to die from pneumonia or influenza than non-diabetic patients.
  - ✓ **Causes:**
    - 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.

- Abdominal infection:
  - ✓ Severe fulminating Cholecystitis (gall bladder infection).
  - ✓ **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

- Genitourinary infections:
  - ✓ **Asymptomatic bacteriuria** (> 100,000 /ml urine) is common.
  - ✓ Symptoms/ Signs and time of onset similar to non-diabetics[1].
  - ✓ Diabetes is an indication for screening for treating asymptomatic bacteriuria.
  - ✓ **Cystitis:** same as non-diabetics, incomplete bladder emptying and high incidence of unsuspected upper UTI.
  - ✓ **Cause:** Bacteria (Gram negative rods or group B streptococci) or fungi (Candida albicans) may be involved.
  - ✓ **Bilateral Pyelonephritis**[2]**:** diabetes predisposes to a more severe infection of the upper urinary tract.
  - ✓ **Emphysematous Pyelonephritis**[3] 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:** In type- 2 diabetes ;mucosal colonization with C.albiacns is common. Although it is common to be caused by non-albicans Candida spp. in patients with poor glycemic control.

1 Usually UTI in DM is asymptomatic, but in some cases the patient feels burning sensation during urinating.
2 Pyelonephritis: the infection reaches the kidney.
3 Emphysematous Pyelonephritis: severe infection causes dilatation in the renal parenchyma accompanied by severe pain

- Skin Infections:
  - ✓ **Risk factors in diabetic patients:**
    - Sensory neuropathy: no pain perception.
    - Atherosclerotic vascular disease
    - Hyperglycemia : >250 mg/ dl increased risk
    - History of cellulitis, peripheral vascular diseases, Tinea, and dry skin.
  - ✓ **Organisms:**
    - Streptococcus pyogenes (Group A Streptococcus (GAS))
    - S.aureus
    - CA-MRSA (community acquired -MRSA) is of concern causes (77%) of skin and soft tissue infections .
  - ✓ Necrotizing fascitis:

    a deep –seated ,life threatening infection of subcutaneous tissue with progressive destruction of fascia, fat and muscle.
    - **Causes:**10% associated with GAS (group A streptococcus) ,with or without S.aureus, anaerobes may be a 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 (penicillin).

- Diabetic foot infections:
  - ✓ the most common and most important soft tissue infection in diabetic patients, 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:** 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 .
  - ✓ **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.
  - ✓ Infection may involve the skin, soft tissues, bone ,or all.
  - ✓ Diabetic neuropathy may lead to incidental trauma that goes unrecognized.
  - ✓ Sinus tract may be present
  - ✓ **Diagnosis:**
    - 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

- Clinical presentation of diabetic foot infection
  - ✓ **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
- 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.

Organisms involved in diabetic foot infections	
Cellulitis	1. beta-hemolytic streotococci (group A,B streptococi), 2. S.aureus, 3. Entertobacteriacae[1] (in chronic ulcers).
Macerated ulcer or nail injury (sinus)	P.Aeruginosa
Deep soft tissue infections	1. GAS 2. Clostridium (gas producing gram +ve bacilli)
Chronic osteomyelitis	1. GAS 2. Group B Sterptococcus 3. S.aureus, 4. Enterobacteriacae[1] 5. Bacteroides fragilis

1 Entrobacteriacae: E.coli, Klebsiella & proteus spp.

- 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.

Summary

Infection	Clinical presentation	Causes
vulvovaginitis	Pain, itching & abnormal discharge	Canidida albicans
Otitits externa	Pain, otorrhae, hearing loss	P,aerugenosa
Rhinocerebral mucormycosis	Facial & ocular pain	Rhizopus absidia
Pneumonia	fever, shortness of breath, reproductive cough	S.aureus, S.pneumoniae, Myobacterium tuberculosis
Genitourinary	Asymptomatic	Enterobacteriaceae (E.coli), group B strepto & c.albicans
Cholecystitis	Pain in abdomen	enteric gram negative
Necrotizing faciitis	Pain, Violaceous discoloration, crepitus & gas seen in radiology	GAS
Cellulitis	Tender, erthematous lesion	Group B Streptococcus, GAS, S.aureus, Enterobacteriaceae
Deep tissue infection	Acute, painful induration of the limb	GAS
Chronic osteomyelitis	Fever, foul discharge	GAS, group B streptococcus, S.auerus, Enterobacteriaceae

Quiz

1. A 59-year-old male patient presented in the clinic with impairment of his hearing ability & otorrhea. From the history he has uncontrolled diabetes. On further investigation the organism showed gram negative and oxidative positive

What is the most likely organism which can cause his problem?

a) Staphylococcus aureus b) Entrobacteria c) Pseudomonus aurigenosa d) Legionella

2. from previous scenario, What is the site of the infection?

a) Vulvovegenitis b) skin infection extended to his ear

c) otitis externa secondary to a pneumonia d) otitis externa extends to adjacent soft tissues

3. A patient has uncontrolled DM for a long time, and he developed chronic cough. which of the following is the most likely organism? (Hint: which one causes LRT infection)

a) Campylobacteria b) Streptococcus group B

c) Myonacterium tuberculosis d) Pseudomonsu aurigenosa

ANSWERS: 1.C 2.D 3.C

Quiz

ANSWERS: 1.A 2.A 3.B

4. What is the most cause of vulvovaginitis in type 2 DM?

a) Candida albicans b) Staphylococcus aureus

c) Streptococcus group B d)Pseudomonsu aurigenosa

5. A 76-year-old patient came to the clinc because of pain in his feet. On examination, there is a tenderness on erythromtous area. The lesion is not raised. There is a swallowing on lymph nodes (lymphangitis). There is no sign for fluid-filled sac under his skin (bullae).

What is the most likely affected tissue in this case.

a) Cellulitis b) Deep skin infection c) Osteomyelitis d) Necrotizing fasciitis

6. What is the most likely in previous scenario?

a) Staphylococcus aureus b) Group A streptococcus c) E. Coli d) Proteus