

LECTURE (1) INFECTIONS IN DIABETIC PATIENTS

OBJECTIVES:

- Not Given
- This worked is based on the lecture slides.
- We added some information from Prof. Kambal, and Dr. Ali.
- Focus on the text with red color.
- Summery is very IMPOERTANT 😊
- If you answered the questions then you are almost ready for the exam 😊
- We hope we made this lecture easier for you

THANK YOU

&

WE WISH YOU FULL MARKS

DONE BY:

Rakan AlMutairi 😊 Khaled AlOsaimi 😊 Abdullah AlAnzi 😊

REVIEWED BY:

Joharah Almubrad

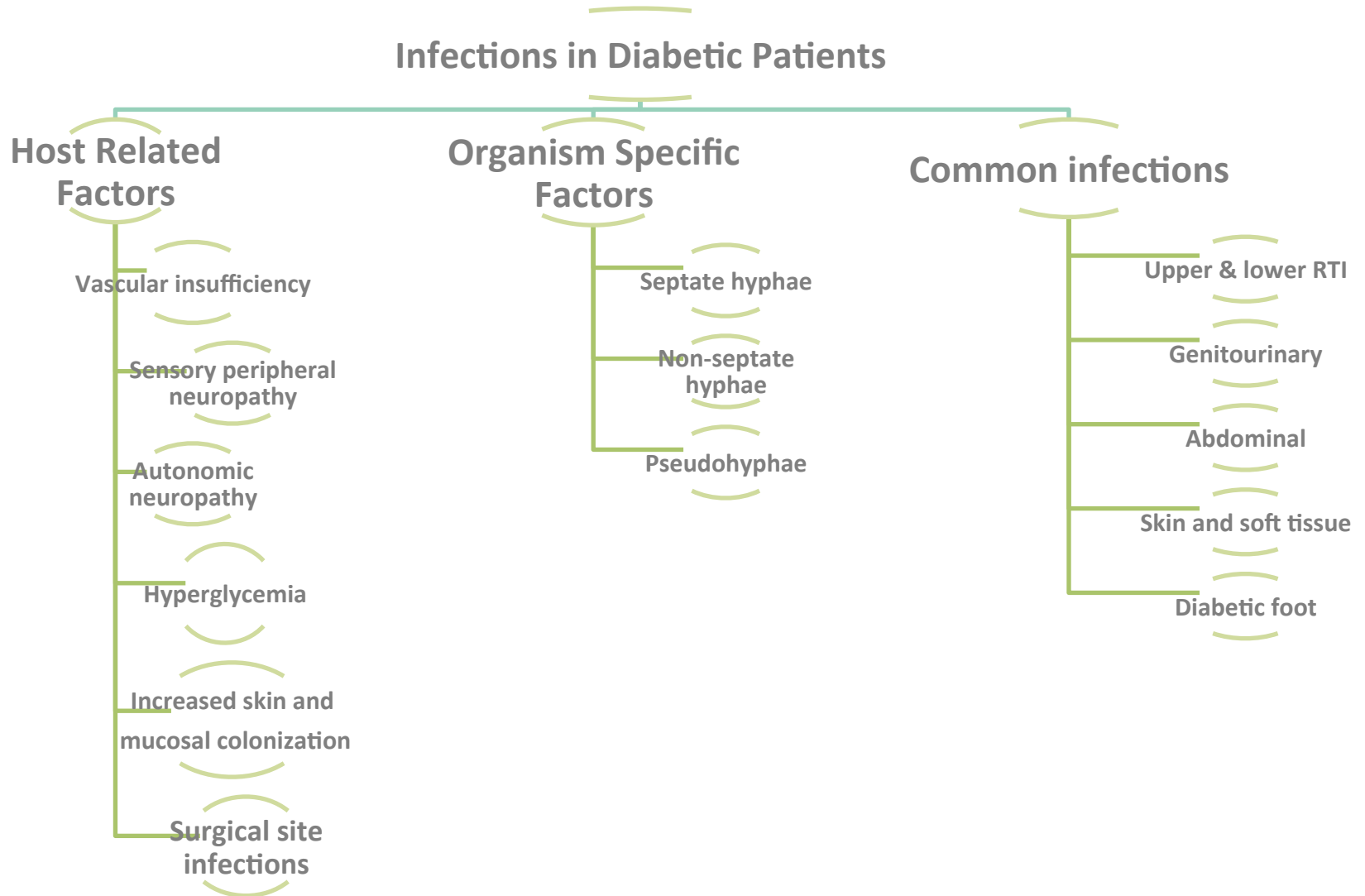
Very important

Additional information

Male doctor's notes

Female doctor's notes

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 IN DIABETIC PATIENTS

1. Vascular insufficiency:

result in local tissue ischemia that enhances the growth of microaerophilic 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.

2. Sensory peripheral neuropathy:

Minor local trauma → may lead to skin ulcers → finally cause diabetic foot infections.

3. Autonomic neuropathy:

Diabetic patients may develop urinary retention and stasis → predisposes to develop UTIs.

HOST RELATED FACTORS IN DIABETIC PATIENTS



4. Hyperglycemia and metabolic derangements

5. Immune defects in diabetes such as:

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

6. Increased skin and mucosal colonization:

- Because of insulin treatment → asymptomatic nasal and skin colonization with *S.aureus*, particularly MRSA “Methicillin-resistant *Staphylococcus aureus*”.
- 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.albicans* is common.
- **Vulvovaginitis** caused by non-*albicans* *Candida* spp. is common in patients with poor glycemic control.

7. Surgical site infections:

associated with postoperative hyperglycemia which is related to deleterious effect on chemotaxis, phagocytosis and adherence of granulocytes.

Prof. Kambal said, Antibiotics should be given before surgery.

ORGANISM SPECIFIC FACTORS

1) Non-septate hyphae (Zygomycosi) :

in high glucose acidic conditions → ketoacidosis → allow *Rhizopus* spp. → cause **Mucormycosis** (Zygomycosis) to thrive

- NB: most important is Rhizopus because dr.ali said we will give u in case scenario "Non septated hyphae" **hyphae means "branching filamentous structure of a fungus"**

2) Pseudohyphae and budding yeast cells (Candida):

" glucose inducible": "adhesion of *C.albicans* to buccal or vaginal epithelium" → , impairs phagocytosis, giving the organism advantage over the host. that is why **its cause**

Vulvovaginitis

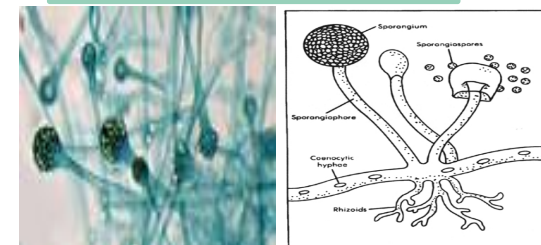
COMMON INFECTIONS IN DIABETIC PATIENTS:

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

Candida



Rhizopus



1) UPPER RESPIRATORY TRACT INFECTIONS

1. Invasive (Malignant) Otitis Media, uncommon but potentially life threatening. YOU SHOULD MEMORISE THOSE 4:

1) Invasive to adjacent soft tissues, mastoid and temporal bone, and brain (malignant) IN “DM patient “

2) Severe infection. 3) Pathogenic organism is “P.aeruginosa” 4) Treat by surgical debridement

- Patient present with severe pain, otorrhea, and hearing loss. Intense cellulitis 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.

2. Rhinocerebral Mucormycosis: “life threatening fungal infection“

YOU SHOULD MEMORISE THOSE 6:

Patient present with:

1) Headache 2) Swelling nose 3) Nasal discharge

4) With DKA” Diabetic ketoacidosis” Rhizopus, Absidia and Mucor species.

5) **Non-septate hyphae(Zygomycosi) “Rhizopus”**

6) **Treatment** :surgical debridement and prolonged IV therapy with Amphotericin B.

Diagnosis: biopsy of necrotic tissue

2) LOWER RESPIRATORY TRACT INFECTIONS:

PNEUMONIA AND INFLUENZA

- Diabetic patients are 4 times more likely to die from pneumonia or influenza than non-diabetic patients.

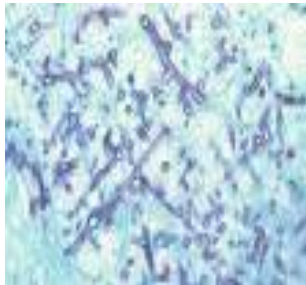
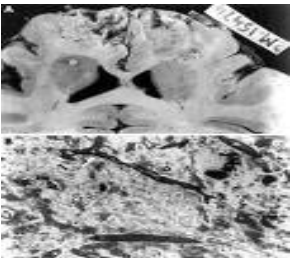
Common organisms:

- **Gram positive bacteria : *S.aureus* , *S.pneumoniae*.**
- Gram negative bacteria: Enterobacteria and Legionella.
- Other organisms: **Influenza virus** & Mycobacterium tuberculosis .

DR. Ali only focused on *S.pneumoniae* & Influenza virus most important is :

Routine pneumococcal vaccination and influenza recommended.

Prof. Kambal ONLY spoke about Gram positive bacteria, so keep them in mind 😊



3) GENITOURINARY INFECTIONS



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

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

Diabetes is an indication for screening for treating asymptomatic bacteriuria.

B. 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.

C. 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.

D. Vulvovaginitis : as mentioned earlier.

4) ABDOMINAL INFECTIONS not important

- **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

5)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 :

1) 10% associated with Group A Streptococcus (GAS) “Streptococcus pyogenes” ,with or without S.aureus, anaerobes may be involved.

2) Clostridium perfringens most common bacterial agent for gas gangrene

- **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.

Prof. Kambal Notes:

- S. Pneumoniae common infection for DM. They are capsulated, and hard to be phagocytized
- Necrotizing fasciitis is caused by bacteria’s toxins, we use Antibiotics for stopping protein synthesis.

5)SKIN AND SOFT TISSUE INFECTIONS

DIABETIC FOOT INFECTION:

Prof. Kambal Said: not important but read it

- 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.
- **Pathophysiology:**
 - microvascular 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

ORGANISMS INVOLVED IN DIABETIC FOOT INFECTIONS

- 1) Cellulitis:** beta-hemolytic streptococci (group A,B streptococi), S.aureus, Enterobacteriaceae (E.coli, Klebsiella, Proteus spp.) in chronic ulcers.
- 2) Macerated ulcer or nail injury (sinus) :** P.aeruginosa.
- 3) Deep soft tissue infections (necrotizing fasciitis, or myositis):** GAS & gas producing gram positive bacilli (Clostridium).
- 4) Chronic Osteomyelitis:** GAS and Group B Streptococcus, S.aureus, Enterobacteriaceae (E.coli ,Proteus mirabilis , K.pneumoniae.) & Bacteroides fragilis
 - **Factors that increases the development of Osteomyelitis:** grossly visible bone or ability to probe to bone ESR >70 mm/hr

CLINICAL PRESENTATIONS OF DIABETIC FOOT INFECTIONS

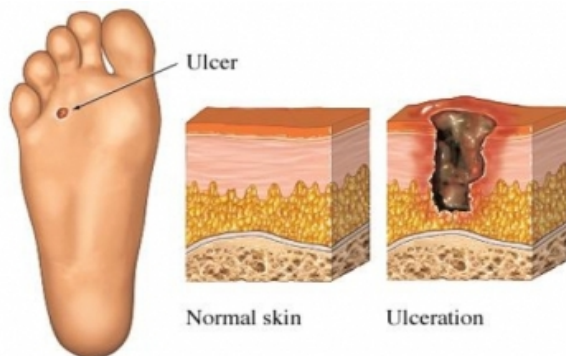
- **Cellulitis:** tender, erythematous non-raised skin lesion on the lower limb ,may be accompanied with lymphangitis which suggests GAS.
Bullae suggests S.aureus ,occasionally GAS.
- **Deep skin and soft tissue infections:** patient acutely ill, with painful induration of the limb especially the thigh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

Prof. Kambal Said: 😊😊

To test it, we need deep tissue for analysis.



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, Cephadrine, 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.

SUMMARY



- Host Related Factors in diabetic patients

Vascular insufficiency, Sensory peripheral neuropathy, Autonomic neuropathy, Hyperglycemia and metabolic derangements, Immune defects, Increased skin and mucosal colonization, and Surgical site infections.

- In type-2 diabetes ;mucosal colonization with *C.albicans* is common. Vulvovaginitis caused with *C.albicans* or non-albicans *Candida* spp. is common in patients with poor glycemic control.

- “ketoacidosis allow ”**Rhizopus**” which cause Mucormycosis (Zygomycosis) to thrive in high glucose acidic conditions.

- “adhesion of *C.albicans* to buccal or vaginal epithelium” → , impairs phagocytosis, giving the organism advantage over the host. that is why its cause **Vulvovaginitis**

- Invasive otitis media:

1) Invasive to adjacent soft tissues, mastoid and temporal bone, and brain (malignant) IN “DM patient “

2) Sever infection. 3) Pathogenic organism is “*P.aeruginosa*” 4) Treat by surgical debridement

- Rhinocerebral Mucormycosis:

“life threatening fungal infection”:

1) Headache

2) Swelling nose

3) Nasal discharge

4) With DKA” Diabetic ketoacidosis” *Rhizopus*, *Absidia* and *Mucor* species.

5) Non-septate hyphae(*Zygomycosi*) ”**Rhizopus**”

6) Treat by surgical debridement and prolonged IV therapy with Amphotericin B.

SUMMARY



- Lower Respiratory Tract Infections:

Common organisms: Gram positive bacteria: **S.aureus** , **S.pneumoniae**.

Routine pneumococcal vaccination and influenza recommended

- Abdominal infections :

Common causes: enteric Gram negative bacteria and **Anaerobes**

- S. Pneumoniae common infection for DM. They are capsulated, and hard to be phagocytized

- Necrotizing fasciitis is caused by:

1) 10% associated with **Group A Streptococcus (GAS)** “Streptococcus pyogenes” ,with or without S.aureus, anaerobes may be involved.

2) **Clostridium perfringens** most common bacterial agent for **gas gangrene**

- Necrotizing fasciitis is caused by bacteria’s toxins, And we use Antibiotics for stopping protein synthesis.

- **Diagnosis of Foot Infections: Deep specimens (tissues) for culture and susceptibility testing**

Q1: In type-2 diabetes which organism is common for mucosal colonization?

And What does it cause?

A- *P.aeruginosa*, Invasive otitis media.

B- *C.albicans*, *Vulvovaginitis*.

C- *Rhizopus*, Rhinocerebral

Mucormycosis.

Q2: Diabetic patient came with severe infection, and presented with severe pain, otorrhea, and hearing loss. Intense cellulitis and oedema of the ear canal.

What's the disease, and pathogen respectively?

A- Necrotizing fasciitis, GAS.

B- *Aspergillus*, paranasal sinus infections.

C- Invasive otitis media, *P.aeruginosa*.

Q3: How do we prevent a diabetic patient from getting LRTIs?

A- IV Antibiotics.

B- Surgical debridement 😊

C- Routine pneumococcal vaccination and influenza recommended.

Q4: What is the specimen to be cultured, and used for susceptibility testing in a diabetic foot infection?

A- Blood.

B- Skin specimen.

C- Deep tissue.

Q5: A diabetic patient presented with Lower Respiratory Tract Infection. What are the most common pathogens to cause it?

A- *S.aureus* & *S.pneumoniae*.

B- *C.albicans* & *Rhizopus*.

C- *P.aeruginosa* & *Clostridium perfringens*.

Q6: Diabetic patient presented with Swelling nose, Headache, Nasal discharge With Diabetic ketoacidosis. He was diagnosed with Rhinocerebral Mucormycosis. What is the most common pathogen, and treatment?

- A- Rhizopus, Amphotericin B.
- B- Clostridium perfringens, aggressive surgical debridement.
- C- Legionella, Vaccine 😊.

Q7: Diabetic patient was diagnosed by Necrotizing fasciitis. What are the most common pathogens to cause it?

- A- Clostridium perfringens & GAS.
- B- E.coli & Klebsiella.
- C- C.albiacns & Rhizopus.

Q8: What is the most common bacteria for gas gangrene?

- A- S.pneumoniae.
- B- GAS
- C- Clostridium perfringens.

Qs	1	2	3	4	5	6	7	8
answer	B	C	C	C	A	A	A	C

FOR ANY SUGGESTIONS OR PROBLEMS PLEASE CONTACT
MICROBIOLOGY TEAM LEADERS
KHALED ALOSAIMI AND JOHARAH ALMUBRAD
MICROBIOLOGY432@GMAIL.COM

THANK YOU