

# General pathology of **Infections**

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# Introduction

## Subject outlines

- ❑ General considerations
- ❑ Factors affecting development of infection
- ❑ Effects of infection
- ❑ Routs of infections
- ❑ Types of infectious microbes
- ❑ A focus on bacterial infection
  1. Bacteremia
  2. Toxemia
  3. Septicemia
  4. Pyaemia

# Introduction

## General considerations

- **Infection**: invasion of the tissues by micro-organisms with induction of pathological effects.
- **Organism virulence**: ability of the microbe to resist body defense and cause damage of the host tissue.
- **Organism pathogenicity**: capacity of micro-organism to cause a disease.
  - **Pathogenic**: penetrate and damage the host tissue
  - **Non pathogenic**: live on the surface epithelium without tissue damage as bacterial flora and commensals

Non-pathogenic **Reduced immunity** → Pathogenic

# Introduction

## Normal bacterial flora

Skin

Eyes (i.e. Conjunctiva)

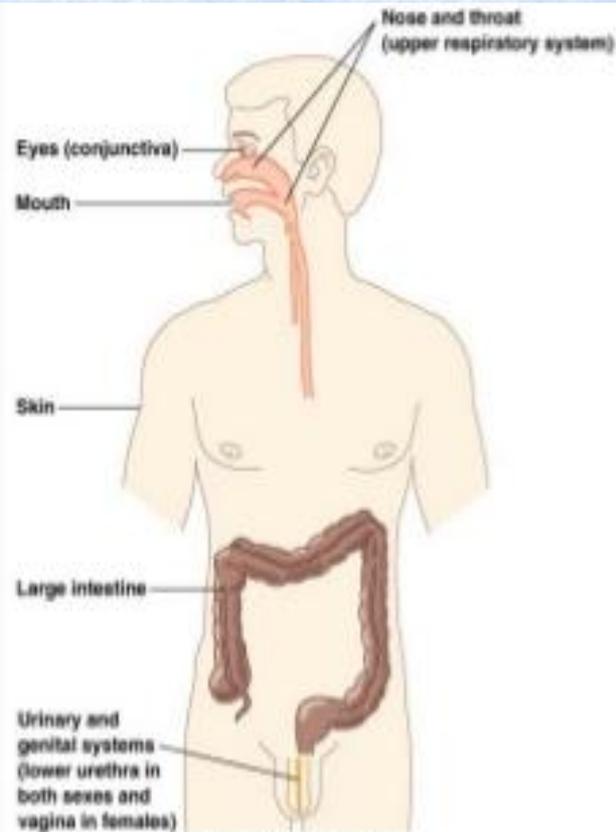
Nose (i.e. Respiratory tract)

Mouth (i.e. Human Oral Cavity)

Ears

Urogenital tract

Elementary tract



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# Introduction

## Factors affecting development of infection

- **Organism factors:**
  - Portal of entry
  - Virulence of the microorganism
  - The dose of infective microbes

- **Host factor:**



### General and natural resistance

- Mechanical Barriers: keratinized epithelia and ciliated epithelium
- Glandular secretions.
- Bacterial Commensals.
- Phagocytic cells.



### Acquired immunity

Due to previous exposure to the infectious agent.

# Introduction

## Effects of infection

- **Unsuccessful (failed) infection:** non-virulent microbe and normal body defense mechanism.
- **Sub-clinical infections:** Infections occur with no symptoms of the host. The host may change to a carrier status
- **Clinically manifested infections:** the organism is virulent enough to cause tissue damage

# Introduction

## Effects of infection



## Pathological effects

**See later**

## Clinical effects

- Incubation period: time between occurrence of infection up to development of symptoms.
- Presentation: symptoms and signs
- Spread (complications)

# Introduction

## Routs of infections

- **Exogenous:**
  1. Direct: penetration of wounded skin or epithelia
  2. Ingestion
  3. Inhalation
  4. Natural passages: urethra, urinary tract, female genital tract
- **Endogenous:** from normal commensals on reduced immunity (opportunistic infections)

# Introduction

## Types of infectious microbes

- I. **Bacterial infections**
- II. **Viral infections**
- III. **Parasitic infections**
- IV. **Fungal (mycotic) infections**

**A focus on bacterial  
o  
infections**

# Bacterial infections

- **Pathogenicity of bacteria occurs due to:**
  1. Adhesions of bacteria to cells causing their damage
  2. Production of toxins (endotoxins and exotoxins) leading to cell injury
  3. Induction of hypersensitivity reactions mainly IV
- **Induction of inflammation occurs due to:**

**A** Direct tissue damage by bacteria or toxins → Acute inflammation

**B** Induction of Ab immune response → Ag/Ab reaction → Chronic inflammation

# Bacterial infections

## Bacteremia

- ❑ **Definition:** circulation of small numbers of bacteria in blood stream.
  
- ❑ **Sources:**
  - After minor surgical procedures as tooth extraction.
  - In a patient with chronic septic focus as chronic tonsillitis and chronic sinusitis
  - During incubation period of some infections as typhoid

# Bacterial infections

## Bacteremia

### □ Effects

- Low virulent bacteria with good immunity: elimination by the immune cells with no harmful effects
- May localize in certain damaged tissues leading to serious effects; as
  - Subacute infective endocarditis caused by streptococcus viridance.
  - Osteomyelitis caused by staph aureus

# Bacterial infections

## Toxemia

- ❑ **Definition:** circulation of bacterial toxins in blood stream
  
- ❑ **Types of bacterial toxins:**
  1. **Endotoxins:** released from dead bacteria and represent part of bacterial wall structure; so induce immune response
  2. **Exotoxins:** synthesized and secreted from alive bacteria and has strong damaging effects

# Bacterial infections

## Toxemia

### □ Types and manifestation of toxemia:

#### Acute toxemia

- Examples: abscess, pneumonia, typhoid meningitis & diphtheria.
- Manifestation
  - General features: high grade fever, rigor, malaise and weakness
  - Severe tissue damage as acute adrenal cortical necrosis, diffuse alveolar damage, myocardial infarction, renal cortical necrosis

#### Chronic toxemia

- Examples: TB and chronic abscesses.
- Manifestation
  - General features: low grade fever, anemia and general weakness
  - Tissue degenerative effect as amyloidosis, liver fatty change, cloudy swelling of renal tubules

# Bacterial infections

## Septicaemia

- ❑ **Definition:** circulation and multiplication of large number of virulent bacteria and their toxins in blood stream
- ❑ **Causative organism:**
  1. **Cocci:** strept hemolyticus, staph aureus, and gonococci.
  2. **Bacilli:** bacillus proteus proteus and anthrax
  3. Endotoxins are released from dead bacteria and represent part of bacterial wall structure; so induce immune response
- ❑ **Sources of bacteria:**
  1. Severe septic infection: meningococcal meningitis, puerperal sepsis
  2. Ordinary infections by high virulent organism with reduced body resistance as abscess, osteomyelitis & infected wound

# Bacterial infections

## Septicaemia

- ❑ **Effects:** a fatal condition due to sever toxemia
  1. Constitutional symptoms: fever, rigors, pallor ....
  2. Tissue necrosis:
    - Suprarenal cortical necrosis (acute adrenal insufficiency).
    - Renal tubular necrosis: acute renal failure
    - Toxic myocarditis: acute heart failure
    - Diffuse alveolar damage: respiratory distress
  3. Hematological effects: hemolysis of RBCs and capillary damage (petechial hemorrhage).
  4. Serous membranes: pleurisy and peritonitis
  5. Spleen: acute splenic swelling.

# Bacterial infections

## Septicaemia

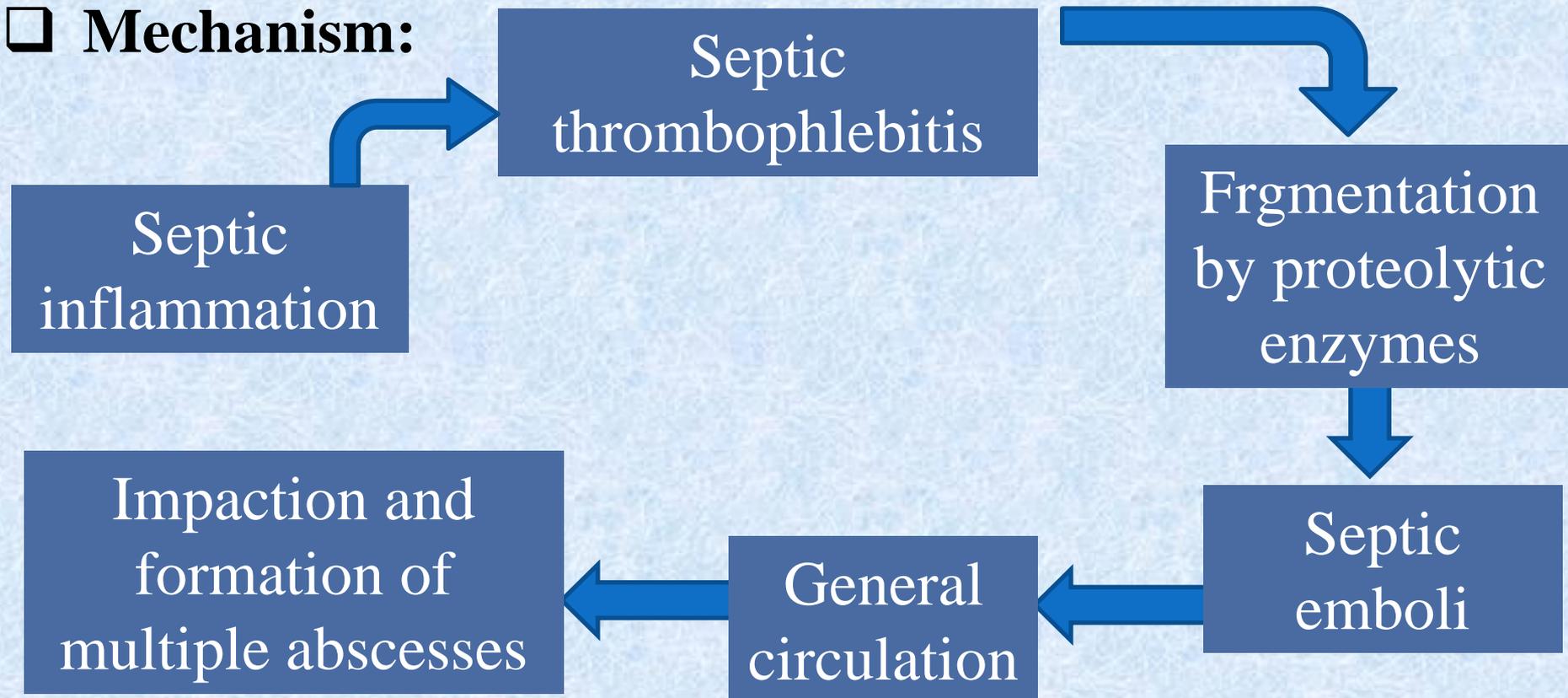
<b>Bacteremia</b>	<b>Septicemia</b>
Low virulent organism	High virulent organism
Small dose	High dose
Transient	Lasting
Trivial or no effects	Major fatal effects

# Bacterial infections

## Pyaemia

❑ **Definition:** circulation of multiple small septic emboli in blood stream

❑ **Mechanism:**



# Bacterial infections

## Pyaemia

### □ Types:

1. Pulmonary pyemia: **source and cours?**
2. Systemic pyemia: **source and cours**
3. Portal pyemia: **source and cours**

# Bacterial infections

## Pyaemia

### □ Types:

1. Pulmonary pyemia: septic emboli from systemic veins (as abscess, cellulitis or osteomyelitis) leads to pyemic lung abscesses
2. Systemic pyemia: Septic emboli from cardiac vegetation or emboli from systemic veins bi-passing the lungs leads to pyemic abscess in CNS, kidneys and other organs.
3. Portal pyemia: Septic emboli arising from portal area (appendicitis, diverticulitis, cholecystitis) leads to pyemic liver abscesses.

# Bacterial infections

## Pyaemia

### ❑ Pathological features of pyemic abscesses:

#### Grossly

- Multiple
- Small
- Peripheral
- Rounded
- Yellow

#### MP

- Central zone of necrosis
- Zone of suppuration
- Outer zone of acute inflammation

### ❑ **Complications:** show features of acute toxemia (see before)

# Bacterial infections

## Types of bacterial infections

Acute

Pyogenic

1. Abscess
2. Boils
3. Carbuncle
4. Meningitis
5. Pyelonephritis

Non-pyogenic

1. Typhoid fever
2. Bacillary dysentery
3. Cholera
4. Diphtheria

Chronic

Non specific

Specific  
(Granuloma)

- Granuloma as:
1. TB
  2. Leprosy
  3. Rhinoscleroma
  4. Syphilis
  5. Actinomycosis

*Thank you*