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PATHOPHYSIOLOGY

UNIT 5

TOPIC :

- **Infectious diseases :** Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections

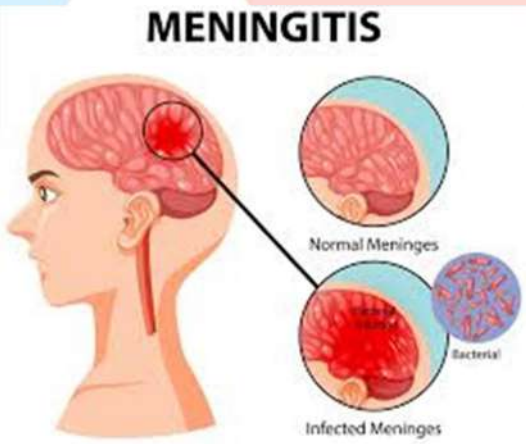
Infectious diseases

Meningitis

→ Meningitis is an acute inflammation of the meninges — the protective membranes that cover the brain and spinal cord.

→ It is a medical emergency and can be life-threatening if not treated promptly.

→ Meningitis is the inflammation of the meninges, usually caused by infection with viruses, bacteria, fungi, or other microorganisms.



Types of Meningitis

Type	Cause	Features
Bacterial Meningitis	*Streptococcus pneumoniae*, *Neisseria meningitidis*, *Haemophilus influenzae*	Severe, medical emergency
Viral Meningitis	Enteroviruses, Herpes simplex virus	Milder, often self-limiting
Fungal Meningitis	*Cryptococcus neoformans*	Affects immunocompromised individuals (e.g., HIV)
Parasitic Meningitis	Amoebas (*Naegleria fowleri*)	Rare and often fatal
Non-infectious	Cancer, lupus, medications	Non-infectious inflammation

Etiology (Causes)

- **Bacterial**:
  - *Streptococcus pneumoniae*
  - *Neisseria meningitidis*
  - *Haemophilus influenzae* type B
  - *Listeria monocytogenes*
- **Viral**:
  - Enteroviruses
  - Herpes simplex virus
  - Mumps virus
  - HIV
- **Fungal**:
  - *Cryptococcus neoformans* (especially in AIDS patients)
- **Others**:
  - Head trauma, neurosurgery, brain tumors, autoimmune diseases

Pathogenesis

- Pathogens enter the bloodstream or directly invade via trauma/sinuses.
- Cross the blood-brain barrier.
- Multiply in the cerebrospinal fluid (CSF).
- Activate inflammatory response.
- Swelling of meninges and increased intracranial pressure.
- Can result in neurological damage or death if untreated.

Clinical Manifestations

- Fever and chills
- Severe headache
- Neck stiffness (classic sign)
- Photophobia (sensitivity to light)

- Nausea and vomiting
- Altered mental status or confusion
- Seizures
- Skin rash (in meningococcal meningitis)
- Bulging fontanelles in infants
- Positive Kernig's and Brudzinski's signs

Non-Pharmacological Management

1. Isolation

- Patients with **bacterial meningitis** are placed in isolation to prevent the spread of infection (especially meningococcal meningitis).

2. Rest and Hydration

- Complete bed rest and **adequate fluid intake** (IV fluids if necessary) to maintain electrolyte balance.

3. Nutritional Support

- Light, nutritious, and easily digestible meals to maintain energy.

4. Fever and Pain Management

- Use of **cool compresses** and maintaining room temperature.
- Pain can also be managed using hot packs or supportive pillows.

5. Monitoring

- Monitor vital signs (temperature, BP, pulse), neurological status, fluid balance, and signs of **increased intracranial pressure (ICP).**

6. Seizure Precautions

- Prepare for seizures by keeping the bed padded, raising side rails, and having emergency equipment ready.

Pharmacological Management

A. Bacterial Meningitis

Empiric Antibiotic Therapy ***(started immediately)***

Age/Type	Common Antibiotics Used
Neonates	Ampicillin + Gentamicin or Cefotaxime
Children/Adults	Ceftriaxone or Cefotaxime + Vancomycin
Elderly/Immunocompromised	Ceftriaxone + Vancomycin + Ampicillin (to cover Listeria)

- Duration: Usually **10–14 days**, depending on pathogen

Corticosteroids

- **Dexamethasone**: To reduce inflammation and prevent neurological damage (especially in pneumococcal meningitis).

Antipyretics and Analgesics

- **Paracetamol (acetaminophen)**: For fever and pain
- **Ibuprofen**: For inflammation (avoid in severe cases with shock)

Anticonvulsants

- **Phenytoin or Levetiracetam**: If seizures occur

IV Fluids and Electrolytes

- To manage dehydration and maintain BP
- Use cautiously to avoid cerebral edema

B. Viral Meningitis

- Usually self-limiting; **supportive care** is primary.
- **Antiviral drugs**:
  - **Acyclovir** for **Herpes simplex virus (HSV)** meningitis
- Pain relief, fluids, rest, and monitoring

C. Fungal Meningitis

- **Antifungal drugs** (long-term treatment):
  - **Amphotericin B** (IV)
  - **Fluconazole or Itraconazole** (oral/IV)
- Mostly seen in immunocompromised patients (e.g., HIV/AIDS)

Typhoid Fever

- Typhoid, also known as enteric fever, is a systemic bacterial infection caused primarily by Salmonella typhi (a gram-negative bacterium).
- It spreads via the fecal-oral route through contaminated food or water.

Etiology (Cause)

- **Causative organism**: *Salmonella typhi*
- Transmission:
  - **Contaminated food/water**
  - Poor sanitation
  - Carriers (infected individuals who don't show symptoms)

Pathogenesis

1. Ingestion of *S. typhi*
2. Bacteria pass through the intestinal wall → enter bloodstream
3. Multiply in **reticuloendothelial system** (liver, spleen, bone marrow)
4. Re-enter bloodstream → cause **bacteremia and systemic symptoms**
5. May invade the gallbladder, intestines → **ulcers, perforation**

Clinical Manifestations (Symptoms)

- **Sustained high fever** (up to 104°F)

- **Headache**, weakness, fatigue
- **Abdominal pain**, bloating
- **Constipation or diarrhea**
- **Rose spots** (pink rashes) on abdomen
- **Loss of appetite**
- **Hepatosplenomegaly** (enlarged liver and spleen)
- **Bradycardia** (slow heart rate)

Non-Pharmacological Management

1. Isolation

- To prevent transmission to others, especially during active infection

2. Hydration

- Oral rehydration salts (ORS) or IV fluids to treat **dehydration** caused by fever or diarrhea

3. Dietary Management

- **Soft, high-calorie, and easily digestible food**
- Avoid spicy, fried, or raw food
- Encourage **small, frequent meals**

4. Rest

- Complete bed rest is essential during the acute phase of illness

5. Hygiene

- Handwashing with soap before eating and after using the toilet
- Safe drinking water and hygienic food preparation

6. Public Health Measures

- Proper **sanitation, sewage disposal**, and **vaccination** in endemic areas

Pharmacological Management

A. Antibiotic Therapy

Drug Class	Examples	Notes
Fluoroquinolones	Ciprofloxacin, Ofloxacin	First-line (in adults); resistance common
Cephalosporins	Ceftriaxone, Cefixime	Preferred in **children & resistant cases**
Macrolides	Azithromycin	Alternative in resistant typhoid
Chloramphenicol	(rarely used now)	Historic first-line; bone marrow toxicity
Trimethoprim-Sulfamethoxazole	Cotrimoxazole	Used if sensitive

Duration: **7–14 days**, depending on severity and response

B. Supportive Medications

- **Antipyretics**: Paracetamol to reduce fever
- **Antiemetics**: Ondansetron or domperidone for nausea/vomiting
- **Proton Pump Inhibitors (PPIs)**: If gastric symptoms occur

Leprosy (Hansen's Disease)

- Leprosy is a chronic infectious disease caused by Mycobacterium leprae, which mainly affects the skin, peripheral nerves, mucous membranes, and eyes.
- It is a slow-growing bacterium.
- Transmitted primarily through respiratory droplets or prolonged skin contact.
- Incubation period: 3 to 5 years (can range from 6 months to 20 years).

Types of Leprosy (Based on WHO classification):

1. **Paucibacillary (PB):**
   - ≤ 5 skin lesions
   - No detectable bacilli in skin smears
2. **Multibacillary (MB):**
   - 5 skin lesions
   - Positive skin smear for bacilli

Etiology (Cause):

- Causative agent: *Mycobacterium leprae*
- Mode of transmission:
  - **Prolonged close contact** with untreated patients
  - Inhalation of droplets (nasal secretions)
  - Rarely through broken skin

Pathogenesis:

1. *M. leprae* enters the body (via respiratory route or skin)
2. Invades **macrophages** and **Schwann cells** (nerve tissue)
3. Leads to:
   - **Nerve damage** (loss of sensation)
   - **Skin lesions**
   - **Ulcers and deformities** in advanced stages

Clinical Features (Symptoms):

Skin:

- Light or reddish patches with **loss of sensation**
- Nodules or thickened skin
- Dryness and cracking

Nerves:

- Tingling or numbness
- Muscle weakness
- **Claw hand, foot drop**

Others:

- Eye dryness or blindness (if eyes involved)
- Non-healing ulcers
- Loss of eyebrows, nasal collapse

Non-Pharmacological Management:

- **Health education**: To reduce stigma, improve early detection
- **Physiotherapy**: Prevent and manage deformities
- **Ulcer care**: Daily inspection and cleaning of feet/hands
- **Rehabilitation**: Vocational and social integration
- **Protective footwear**: To prevent injury due to numbness
- **Isolation**: Not usually required once treatment starts

Pharmacological Management (WHO MDT - Multidrug Therapy)

For Paucibacillary Leprosy **(PB):**

Duration: 6 months
Drugs:

- **Rifampicin** 600 mg once monthly (supervised)
- **Dapsone** 100 mg daily (self-administered)

For Multibacillary Leprosy **(MB):**

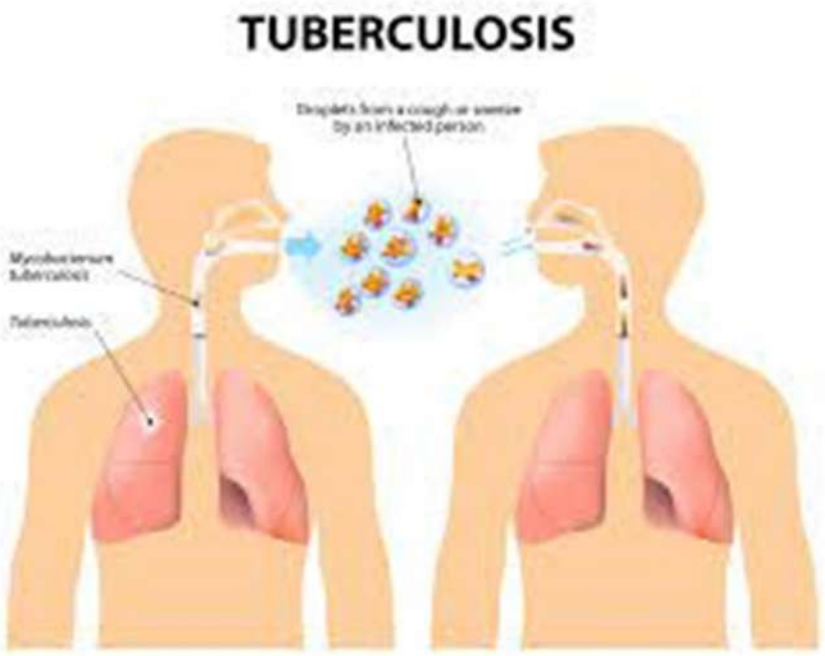
Duration: 12 months
Drugs:

- **Rifampicin** 600 mg once monthly (supervised)
- **Clofazimine** 300 mg monthly + 50 mg daily
- **Dapsone** 100 mg daily

Tuberculosis

→ Tuberculosis is a chronic and progressive infectious disease and affect the lungs usually and its causative agent is mycobacterium tuberculosis or mycobacterium bovis.

→ It is an airborne disease.



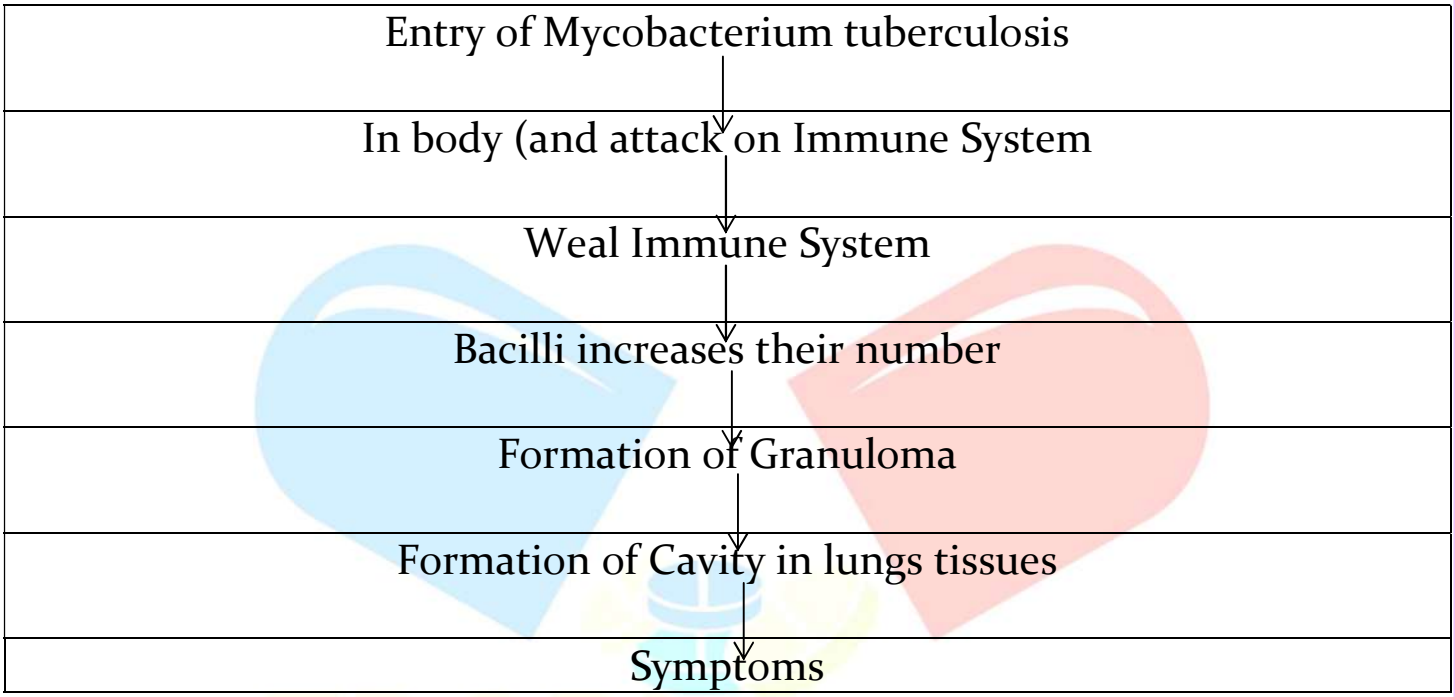
Types of TB

- **Pulmonary TB (Primary) :** Tuberculosis in Lungs.
- **Extra Pulmonary TB :** Tuberculosis in other organs.

Etiology

- Droplet Infection
- Intake of Unpasteurised Cow Milk
- Re-infection
- Diseased Condition

Pathogenesis



Clinical manifestations

- Long term cough
- Blood in Cough
- Shortness of breath
- Fever
- Chest pain
- Weight loss

Non-Pharmacological Management

- ❖ TB patient should be Kept in separate room.
- ❖ He should wear mask
- ❖ He should keep towel / Handkerchief during coughing , Sneezing.
- ❖ He should take healthy nutrition .
- ❖ He should follow the directions of healthcare professionals

Pharmacological managements

- **First line of treatment :** Isoniazid, rifampin, ethambutol, pyrazinamide, streptomycin.
- **Second line of treatment :** Ofloxacin, amikacin, moxifloxacin, ethionamide.
- **Third line of treatment :** Linezolid, amoxicillin, azithromycin etc.

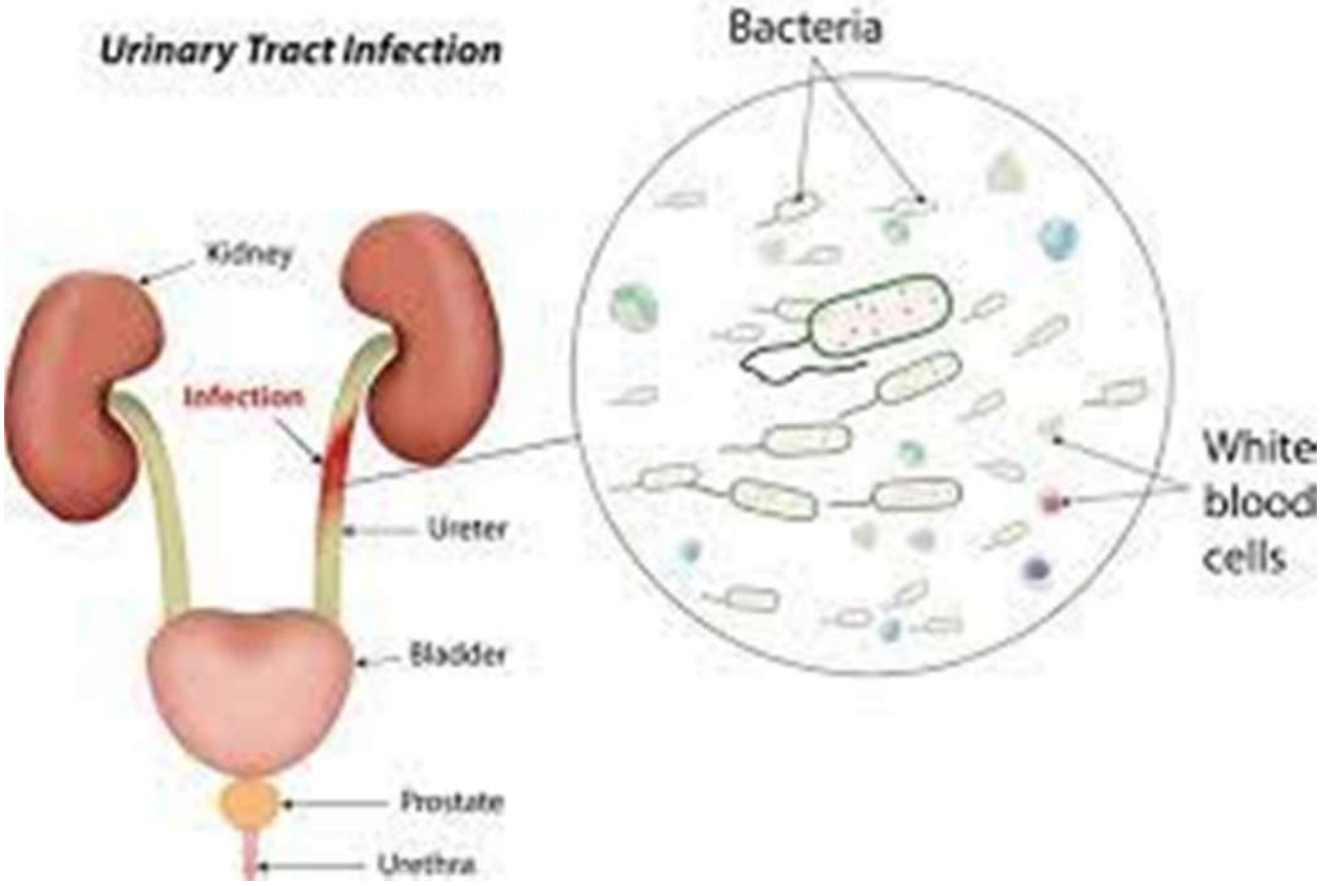
Urinary Tract Infection (UTI)

→ UTI is a Bacterial infection of the urinary Tract.

→ It includes

- Cystitis (infection of Bladder)
- Urethritis (Infection of Urethra)
- Prostatitis (Infection of Prostate gland) and
- Pyelonephritis (infection of Kidney)

→ Females are more prone to infection because of short size of Urethra , and closeness to anus.



Etiology

- **Bacteria :** Commonly UTI is occurs due to E. coli (Escherichia Coli)

Pathogenesis

Entry of Bacteria in preurethral area ,and Colonization (staying and increasing their number there)
↓
after Colonization go upwards to Urinary bladder
↓
Fimbria (hair like structure upon bacteria) help the bacteria in attachment with bladder , and bacterial toxin inhibits the bladder peristalsis and reduces the urine flow
↓
Bacteria penetrate the epithelial cells and go upwards to ureters and Kidney and infect them

Clinical Manifestations

- Pain in the side back , abdomen or in pelvic area .
- Frequency of urination
- Blood in urine
- Pain during urination
- Urination need at night
- Cloudy colour urine , strong bad smell .

Non Pharmacological Management

- Regular hygiene and cleaning are the most important measure to prevent the UTIs.
- Do the sexual activity by using of the proper protections.
- During the menstruation use the sanitizing sanitary pad.

Pharmacological Management

- Antibiotics are used to treat UTI Like amoxicillin , Ciprofloxacin ofloxacin, ciprofloxacin, norfloxacin, amoxycillin etc.