PATHOPHYSIOLOGY

UNIT V
INFECTIOUS DISEASES

MENINGITIS

Meningitis is an Inflammation of meninges. The meninges are the three membranes that cover the brain and spinal cord. Meningitis can occur when fluid surrounding the meninges becomes infected. The most common causes of meningitis are viral and bacterial infections, but can also be cancer, chemical irritation, fungi and drug allergies. Viral and bacterial meningitis are contagious. They can be transmitted by coughing, sneezing or close contact.

➢ Types of meningitis

1. Viral Meningitis
2. Bacterial Meningitis

Viral and bacterial infections are the most common causes of meningitis. There are several other forms of meningitis. Examples include cryptococcal, which is caused by a fungal infection, and carcinomatous, which is cancer-related. These types are rare.

1. Viral Meningitis:

Viral meningitis is the most common type of meningitis. Viruses in the Enterovirus category cause 85 % of cases. These are most common in summer and fall and they include

- Coxsackievirus A
- Coxsackievirus B
- Echoviruses

Others viruses are

- West Nile virus
- Influenza
- Mumps

- HIV
- Measles
- Herpes viruses

2. **Bacterial meningitis**

Bacterial meningitis is contagious and caused by infection from certain bacteria. It is fatal if left untreated. Between 5 to 40 % of children and 20 to 50 % of adults die with this condition. The most common types of bacteria that cause bacterial meningitis are:

- **Streptococcus pneumoniae:** It is typically found in the respiratory tract, sinuses and nasal cavity, and can cause meningitis called “pneumococcal meningitis.
- **Neisseria Meningitidis:** It is spread through saliva and other respiratory fluids and causes meningitis called “meningococcal meningitis”.
- **Haemophilus influenza:** This can cause not only meningitis but infection of the blood, inflammation of the windpipe, cellulitis, and infectious arthritis.
- **Listeria monocytogenes:** It is a foodborne bacteria.

➢ Symptoms

Viral Meningitis

In infants

- Decreased appetite
- Irritability
- Sleepiness
- Lethargy
- Fever

Bacterial Meningitis

- Altered mental status
- Nausea
- Vomiting
- Sensitivity to light
- Irritability
- Stiff neck
- Fever
- Headache

In adults

- Headache
- Stiff neck
- Decreased Appetite
- Seizures
- Lethargy
- Sensitivity to bright light
- Nausea

➢ Risk Factors:

The following are some of the risk factors for meningitis:

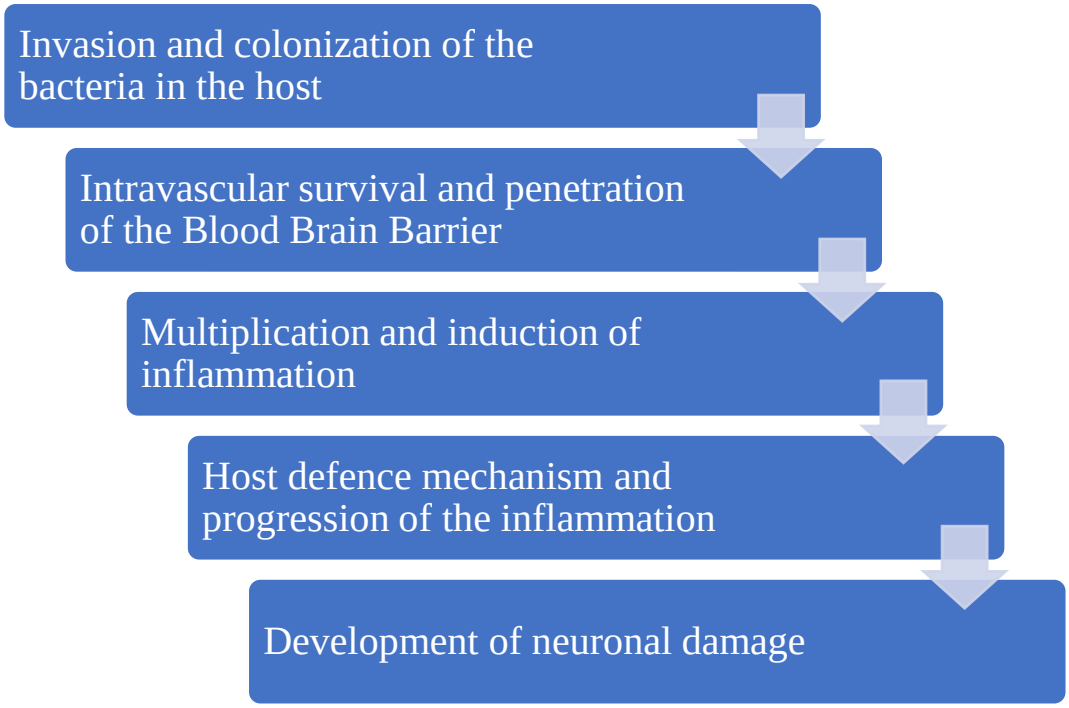
Compromised Immunity: An immune deficiency is more vulnerable to cause meningitis infections. Certain disorders and treatments can weaken immune system. These include:

- HIV
- AIDS
- Autoimmune disorders
- Chemotherapy
- Organ or bone marrow transplants

Community Living: Meningitis is easily spread when people live in close quarters

Pregnancy: Pregnant women have an increased risk of listeriosis.

➢ Pathophysiology



➢ Diagnosis

- **Physical exam** - Physical exams like monitoring of fever, an increased heart rate, neck stiffness can be important clues for the diagnosis of meningitis.
- **Complete blood count -** Identification of bacteria in the blood. Bacteria can travel from the blood to the brain. N. meningitidis and S. pneumoniae can cause both sepsis and meningitis.
- **Chest X-rays -** Chest X-rays can reveal the presence of pneumonia, tuberculosis, or fungal infections. Meningitis can occur after pneumonia.
- **Lumber puncture -** This test is also called a spinal tap. It allows looking for increased pressure in the central nervous system. It can also find inflammation or bacteria in the spinal fluid.
- **Blood culture -** Identification of bacteria in the blood. Bacteria can travel from the blood to the brain. N. meningitidis and S. pneumoniae can cause both sepsis and meningitis.
- **CT- Scan-** A CT scan of the head may show problems like a brain abscess or sinusitis. Bacteria can spread from the sinuses to the meninges.

➢ Treatment

- **Drugs –** antivirals, antibacterial, antifungal, antiparasitic
- **Vaccine –** Neisseria Meningitides, disseminated tuberculosis

➢ Prevention

- Maintaining a healthy lifestyle
- Not smoking
- Avoiding close contact with patient or sick person
- Vaccination

Typhoid

Typhoid fever is also called enteric fever. It is an acute infectious illness associated with fever that is most often caused by the ***Salmonella typhi*** bacteria. It can also be caused by ***Salmonella paratyphi***, a related bacterium that usually leads to a less severe illness. The bacteria are deposited through fecal contamination in water or food by a human carrier and are then spread to other people in the area.

- **Epidemiology**

Typhoid fever occurs worldwide, primarily in developing nations whose sanitary conditions are poor. Typhoid fever is endemic in Asia, Africa, Latin America, but 80% of cases come from Bangladesh, China, India, Indonesia, Laos, Nepal, Pakistan, or Vietnam.

- **Symptoms**

First week

- Fluctuating fever
- Headache
- Malaise

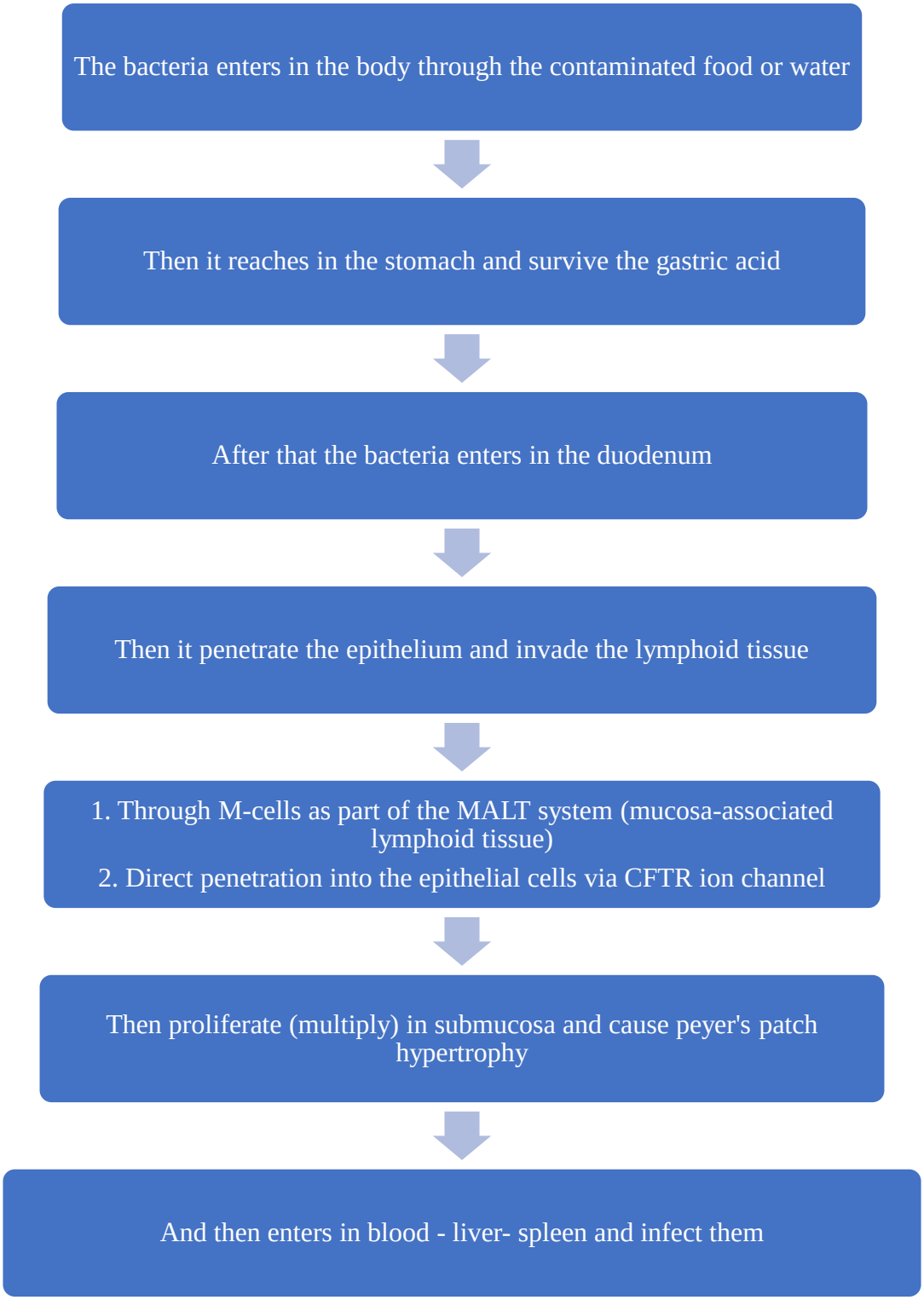
Second week

- High fever
- Bradycardia
- Weakness
- Tender abdomen
- Red spots on abdomen
- Diarrhea

Third week

- High fever
- Dehydration
- Decrease in platelets
- Delerium
- Intestinal haemorrhage

PATHOPHYSIOLOGY



- **Diagnosis**

❖ **Widal test:**

- It is a serological test in which the antibodies in the blood against Salmonella antigens are detected.
- It is a quantitative test
- Test is not able to detect Salmonella during the first week of infection.

❖ **Typhidot test:**

- An ELISA based test
- Detects the presence of IgM and IgG antibodies against the outer membrane protein (OMP) of *Salmonella typhi*
- Test becomes positive within 2-3 days of infection
- Less time-consuming test

- **Treatment**

- Typhoid fever is treated with antibiotics that kill the Salmonella bacteria. Several antibiotics are effective for the treatment of typhoid fever.
- Chloramphenicol was the original drug of choice for many years but it has been replaced by other effective antibiotics.
- Fluoroquinolones like Ciprofloxacin, Gatifloxacin, and Ofloxacin are the most frequently used drugs for nonpregnant patients.
- Ceftriaxone an intramuscular injection medication is an alternative for pregnant patients.

- **Complications**

- Intestinal haemorrhage
- Jaundice

- **Prevention**

- Wash hands thoroughly with soap and water after going to the toilet and before eating.
- Boil or disinfect all water before drinking it.
- Do not eat food or drink beverages from street vendors.

Leprosy

- An infectious disease also known as Hansen's disease.(discovered by gerhard hansen)
- caused by slow growing bacteria- **mycobacterium leprae** or **mycobacterium lepromatosis**.
- Slow developing (6months-40 years) progressive disease that damages the skin and nervous system.
- It results in skin lesions and deformities
- Affect the cooler places of the body - eyes, nose, earlobes, hands, feet, etc.

MODE OF TRANSMISSION

- Human to human (from infected person's nasal secretion or skin lesions)
- other species that carries the bacteria- chimpanzees, monkey, armadillos.

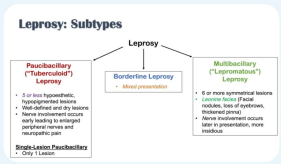
SIGN AND SYMPTOMS

- Discoloured patches of skin.
- Growths (nodules) on the skin
- Thick or dry skin
- Muscle weakness or loss sensation
- enlarged nerves
- Eye problems

PATHOPHYSIOLOGY

- Bacilli enter the body usually through respiratory system.
- After entering the body, bacilli migrate towards the neural tissue and enter the Schwann cells. Bacteria can also be found in macrophages.
- After entering the Schwann cells or macrophage the Bacilli start multiplying slowly (about 12-14 days for one bacterium to divide into two) within the cells.
- then enters in the unaffected cells
- Specific and effective cell mediated immunity (CMI) provides protection to a person against leprosy.
- When specific CMI is effective in eliminating/ controlling the infection in the body, lesions heal spontaneously or it produces pauci-bacillary (PB) type of leprosy.
- If CMI is deficient; the disease spreads uncontrolled and produces multi bacillary (MB)

TYPES



DIAGNOSIS AND TREATMENT

TUBERCULOSIS

Tuberculosis is a contagious bacterial infection that mainly affect the lungs, but may spread to other organs of the body.

Tuberculosis is caused by the bacteria called ***Mycobacterium tuberculosis.*** It is transmitted from person to person via droplets from the throat and lungs of people with the active respiratory disease. Most commonly, tuberculosis is caused by air-borne infection.

- **Epidemiology**

Tuberculosis is most prevalent infectious disease in the world. Tuberculosis is one of India's major public health problems. According to WHO estimates, India has the world's largest tuberculosis epidemic and approx. 2-3 million people are infected with tuberculosis.

- **Etiology:**

Tuberculosis is caused by Mycobacterium tuberculosis, which spread from person to person through microscopic droplets released into the air. This can happen when someone with the untreated, active form of tuberculosis, coughs, speaks, sneezes, spits, laughs or sings.

- **Sign and Symptoms**
  - Cough
  - Fever/chills
  - Night sweats
  - Loss of appetite
  - Fatigue
  - Breathing difficulty
  - Pain in chest

- **Stages of symptoms**
  - **Primary** – exhibit symptoms 1-2 weeks after entry of microorganism.
  - **Latent**- Bacteria engulfed by macrophages lives in dormant phase – no symptoms, no spread of infection.

- **Active**- whenever your immune system weaken bacteria will multiply and make you sick.

➢ **Pathophysiology**

The bacteria enter in the body

↓

Bacteria hoes to alveoli, deposit and multiply

↓

Stimulate body's immune response

↓

Macrophages destroy many bacteria and normal tissue

↓

Dead bacilli and live masses surrounded by macrophages (Ghon's tubercle)

↓

Necrotic degeneration occurs (production of cavity filled with cheese like mass of tubercle bacilli, dead WBCs and dead tissue)

↓

Pulmonary tuberculosis

➢ **Diagnosis**

- **Sputum cytology**: Examination of sample of sputum (mucus) under a microscope to determine whether abnormal cells are present.
- **Sputum culture:** Testing mucus from the lungs is used to diagnose active TB.
- **Rapid sputum test:** This test can provide results within 24 hours.
- **Chest X-**ray: A posterior- anterior chest radiograph is used to detect chest abnormalities.
- **Biopsy**: A sample of the affected area is taken out to look for TB causing bacteria.
- **Urine culture:** This test looks for TB infection in the kidneys (renal TB).
- **Lumbar puncture**: A sample of fluid around the spine is taken to look for a TB infection in the brain (TB meningitis).

- **CT scan:** This test is used to diagnose TB that has spread throughout the body (miliary TB) and to detect lung cavities caused by TB.

➢ **Treatment**

Short term treatment (06 month course of treatment)	**Long term treatment (12 month course of treatment)**
Initiation phase: Four drugs in combination for first two months: Isoniazide Rifampicin Pyrazinamide Ethambutol **Continuation phase:** Initiation phase followed by 4 months of two drug combination: Rifampicin Isoniazid	**Initiation phase:** For first 2 months out of 12 months, use following drugs plus glucocorticoid for first 2-3 weeks Isoniazide Rifampicin Pyrazinamide Ethambutol **Continuation phase:** Initiation phase followed by 10/12 months of two combination: Isoniazid Rifampicin

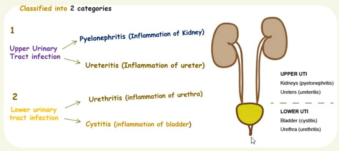
➢ **Prevention**

- Education and screening
- Early diagnosis and treatment
- Leading a healthy life style
- BCG vaccination

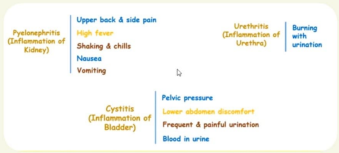
Urinary tract infection

- UTI is the inflammation of the urinary tract
- caused due to the colonization of microorganisms
- it is the most common bacterial infection after the respiratory infection
- it affects kidney, ureters, bladder, urethra
- may be caused by bacteria, virus, fungi or parasites but mainly caused by **E. Coli (Escherichia coli).**
- more common in female than male

Types



SYMPTOMS



RISK FACTORS

- Obstruction
- Bathroom hygiene
- Diabetes
- Weekend immune system

DIAGNOSIS

- Analyzing urine sample - detection of WBC and RBC
- Ct scan
- X-rays
- cystoscopy

TREATMENT

- Amoxicillin
- Nitrofurantoin
- Ampicillin
- ciprofloxacin
- Levofloxacin

PREVENTION

- Drink lots of fluid
- Avoid tight fitting clothes, which trap moisture and can help bacteria grow.
- Take vitamin C
- Taking shower instead of bath

AIDS (acquired immunodeficiency syndrome)

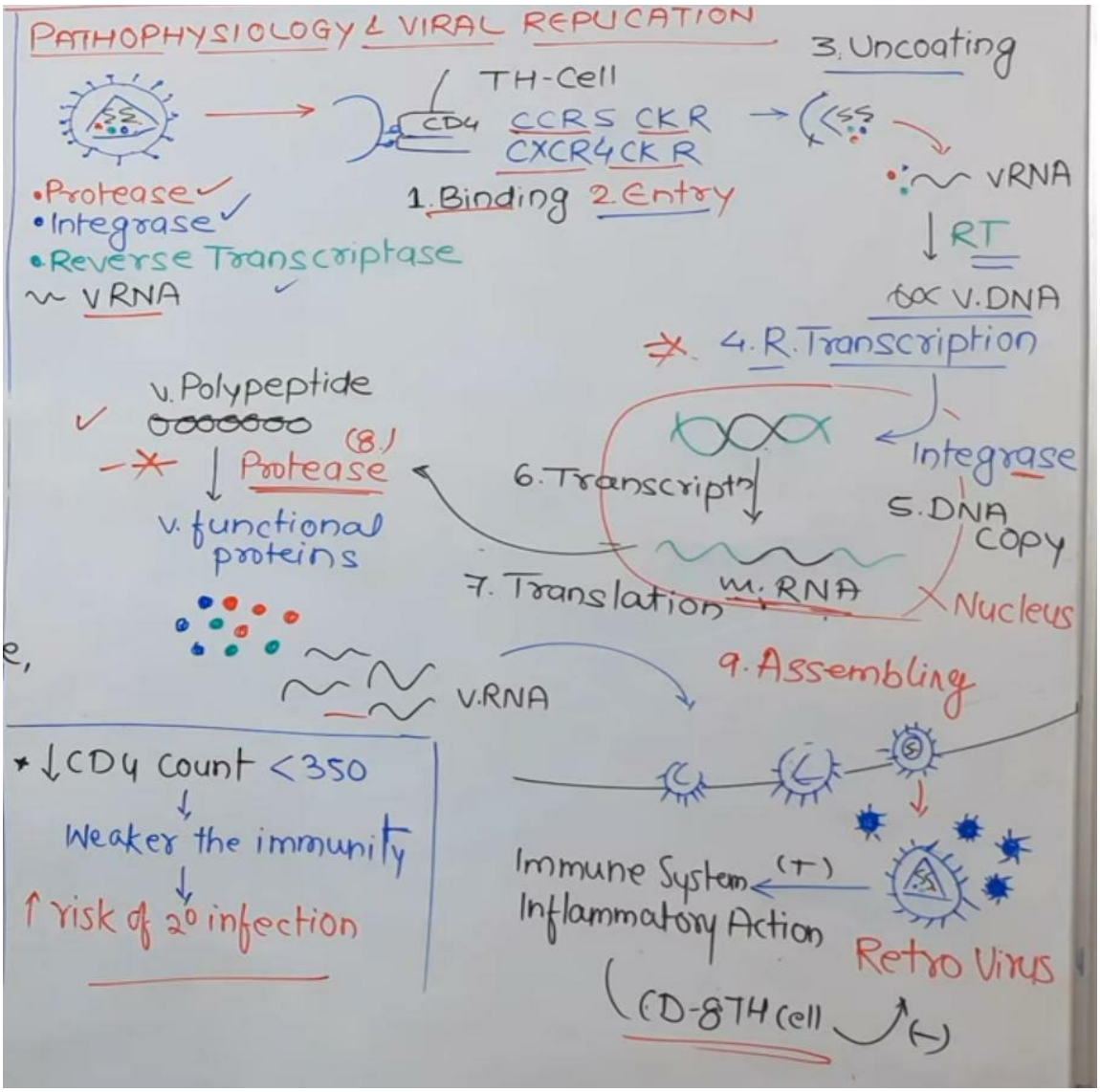
- AIDS is a chronic, life-threatening disease caused by the **human immunodeficiency virus.**
- By damaging immune system, HIV interferes with body's ability to fight against the microorganism or infection.

➢ **Transmission**

- Sexual transmission
- Exposure to infected blood to blood products
- Mother to fetus
- Transplantation of organ from infected person

➢ **Sign and symptoms**

- Shortness of breath
- Fever, chills
- Sore throat
- Weakness
- Weight loss
- Joint pain
- Dry cough
- Vision loss



- **Treatment**

- **Reverse transcriptase inhibitors –** Zidovudine, Lamivudine, Navirapine
- **Protease inhibitors –** Indinavir, Ritonavir
- **Integrase inhibitors-** Raltegravir
- **Entry blocker-** Enfuvirtide, maraviroc

- **Diagnosis**

- **ELISA:** Enzyme linked immuno-sorbent assay was the first screening test for the HIV.

ELISA test use blood, oral fluid or urine to detect HIV antibodies.

- **Western blot test:** Like the ELISA test, the western blot is an antibody detection test.
- **PCR test:** This test detects the genetic material of HIV itself, and can identify HIV in the blood within 2-3 weeks of infection.
- **Antigen test:** Antigen tests require a blood sample. It can be used to diagnose HIV infection earlier from 1-3 weeks after infected with HIV.

- **Prevention**
- Protected physical contact
- Promoting sex education
- Providing awareness

SYPHILIS

- Syphilis is sexually transmitted infection which is caused by **Treponema pallidum.**
- This disease can pass through one person to another person through close physical contact.
- The infected person is often unaware of the disease and unknowingly pass to the other person.

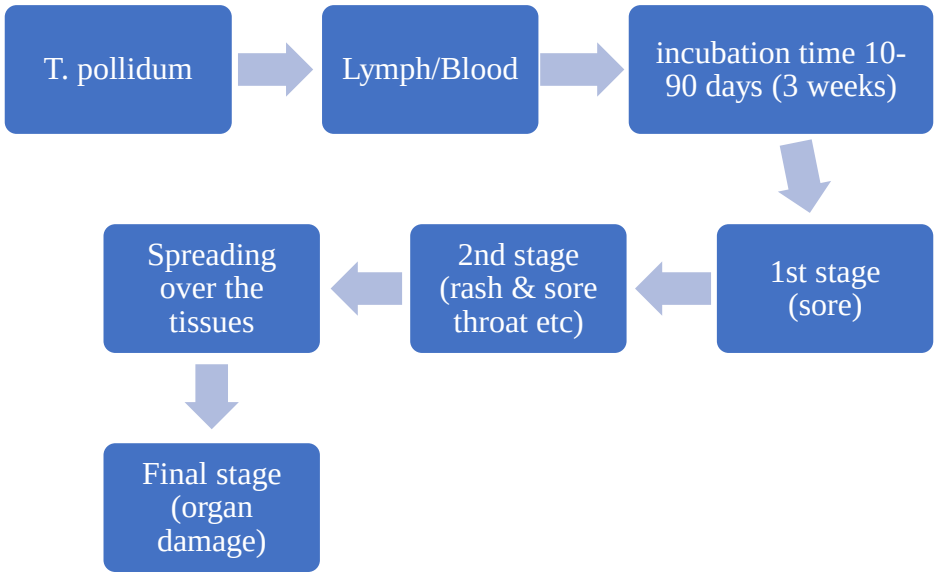
➢ **Stages of Syphilis (infection)**

1. **Primary** – after the 3-4 weeks of infection, small and round sore occur in the body which are painless but infectious.
2. **Secondary**- Skin rash and sore throat, headache fatigue, fever, weight loss, joint pain, hair fall
3. **Latent** – latent or hidden stage, no symptoms as 1st and 2nd stage but remains active for years. If no treatment then progresses to the final stage.
4. **Tertiary** – Final or last stage, occur after years or decades after infection

   Life threatening complications occur such as blindness, deafness, heart diseases

➢ **Pathophysiology**

Spread through unprotected or unsafe sexual activity, blood transfusion, mother to baby, or direct contact with the infected lesions.



- **Treatment**

- **Early infection-** Penicillin G (1st choice), Doxycycline, tetracycline, rifampin
- **Late infection –** same as above but the dose and duration of the treatment will increase
- **Pregnancy –** Benzathine Penicillin G

- **Diagnosis**
  - **Physical exam-** Syphilis is diagnosed by examine the genitals.
  - **Blood test-** Detection of antibodies present in the body against the syphilis bacteria.
  - **Swab test –** If sores are present, a swab (cotton bud) will be used to take a sample of fluid from the sore and checked in laboratory.

- **Prevention**
  - Protected physical contact
  - Promoting sex education
  - Providing awareness
  - Follow up blood test to check presence of bacteria

GONORRHOEA

- Gonorrhoea is a sexually transmissible infection caused by the bacteria known as ***Neisseria gonorrhoeae.***
- It usually affects the genital area, although the throat and anus may also be infected.
- It affects both men and women and easily transmitted through sexual activities.

➢ **Sign and symptoms:** Gonorrhoea can occur with showing any symptoms

Some people never develop symptoms but some do. They are

In men

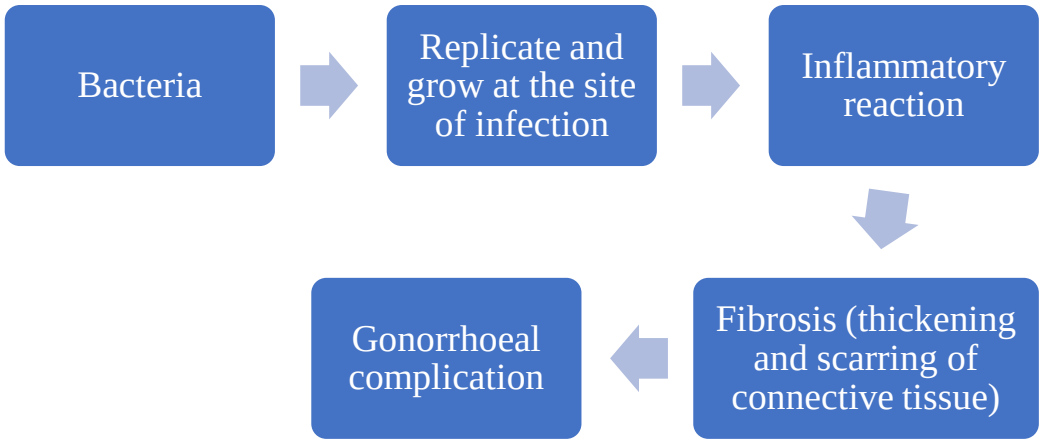
- Burning sensation in penis
- White or yellow pus discharge
- Swelling and pain in testicles

In women

- Vaginal discharge
- Discomfort urination
- Pain While urinating

Pathophysiology

The bacteria having pile which protect them from the phagocytotic action of the neutrophil and IgA protease enzyme which digest the IgA antibodies.



- **Treatment**

- Amoxicillin
- Ampicillin
- Azithromycin
- Probenecid

- **Diagnosis**

- **Urine test – This may help to identify the bacteria in the urethra**
- **Swab test**
- **PCR test**

- **Prevention**

- **Using protection during intercourse**
- **Follow up test**