Chapter-2 (g)
Infectious diseases

Infectious diseases

- Tuberculosis
- Pneumonia
- Urinary tract infections
- Hepatitis
- Gonorrhoea and Syphilis
- Malaria
- HIV and Opportunistic infections
- Viral Infections (SARS, CoV2)

Tuberculosis (TB).

Introduction.

- Tuberculosis is a serious chronic pulmonary and systemic disease caused most often by M. tuberculosis. The source of transmission is humans with active tuberculosis who release mycobacteria present in sputum. According to the World Health Organization (WHO), tuberculosis is estimated to affect more than a billion individuals worldwide, with 8.7 million new cases and 1.4 million deaths each year.
- Tuberculosis flourishes wherever there is poverty, crowding, and chronic debilitating illness. In the United States, tuberculosis is mainly a disease of older adults, immigrants from high-burden countries, racial and ethnic minorities, and people with AIDS. Certain disease states also increase the risk: diabetes mellitus, Hodgkin lymphoma, chronic lung disease (particularly silicosis), chronic renal failure, malnutrition, alcoholism, and immunosuppression.

Etiopathogenesis.

Pathogenesis of tuberculosis is complex and involves several stages.

- Transmission—TB is primarily transmitted through inhalation of respiratory droplets from an infected individual. The bacteria can survive in aerosols for several hours and can be spread in crowded and poorly ventilated areas.
- Infection—When TB bacteria are inhaled, they can penetrate the alveolar spaces of the lungs and are taken up by alveolar macrophages, which are the first line of defence against infection. The bacteria then replicate inside the macrophages, leading to the formation of granulomas, which are collections of immune cells and bacteria.
- Latent tuberculosis infection—In some cases, the immune response is able to contain the infection, and the bacteria remain dormant within the granulomas. This is known as latent tuberculosis infection (LTBI), which is asymptomatic and non-transmissible.
- Reactivation tuberculosis disease—In some individuals, the bacteria can reactivate and cause disease, which is characterized by symptoms such as cough, fever, night sweats, and weight loss. This can occur when the immune system is compromised, such as in HIV infection, or when the individual is exposed to risk factors such as smoking or malnutrition.

Clinical manifestations.

- Chronic cough.
- Sputum production.
- Appetite loss.
- Weight loss.
- Fever.
- Night sweats.

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.

Non-pharmacological managements.

- Follow the all precaution (wearing the mask, sterilize the hand etc.) prior to any activities.
- Take the nutritious diet and make diet chart as per the instruction by the physician.
- Regular check-up and advice of physician is most important factor for the treatment of tuberculosis.
- Follow the daily routine(sleep and awake) and try to practice regular yoga and pranayama.

Pneumonia

Introduction.

- Bacteria like *Streptococcus pneumoniae* and *Haemophilus influenzae* are responsible for the disease pneumonia in humans which infects the alveoli (air filled sacs) of the lungs. As a result of the infection, the alveoli get filled with fluid leading to severe problems in respiration.
- Factors that can increase the risk of developing pneumonia include age, smoking, underlying lung disease, immunodeficiency, and exposure to environmental toxins.

Etiopathogenesis.

The pathogenesis of pneumonia depends on the specific pathogen involved, but in general, it involves the following steps.

- Entry of pathogen— The pathogen enters the body through inhalation, aspiration, or hematogenous spread from another site of infection.
- Adherence and colonization— The pathogen adheres to the surface of the respiratory epithelium and colonizes the lung tissue. This can occur through various mechanisms, such as binding to specific receptors on the host cells or using secreted enzymes to break down host tissue.
- Invasion and inflammation— The pathogen invades the host cells and triggers an inflammatory response, which leads to damage of the lung tissue and production of exudate. The exudate can fill the air sacs of the lungs, leading to difficulty breathing and decreased oxygen exchange.
- Clearance and resolution— The immune system responds to the infection and attempts to clear the pathogen. This can involve activation of phagocytic cells, such as macrophages and neutrophils, and production of antibodies to neutralize the pathogen. In most cases, the infection resolves

without complications, although in severe cases, complications such as sepsis, respiratory failure, and lung abscess can occur.

Clinical manifestations.

- Shortness of breath.
- Chill and sweating
- Fever.
- Productive cough.
- Pleuritic chest pain.
- Hypoxemia.
- Fatigue.
- Tachypnoea.

Pharmacological managements.

- Antibiotics- Azithromycin, moxifloxacin, ceftriaxone, cefepime, tazobactam, vancomycin, metronidazole, trimethoprim.

Non-pharmacological managements.

- Follow the all precaution (wearing the mask, sterilize the hand etc.) prior to any activities.
- Take the nutritious diet and make diet chart as per the instruction by the physician.
- Follow the daily routine (sleep and awake) and try to practice regular yoga and pranayama.

Urinary tract infections

Introduction.

- UTIs stands for Urinary Tract Infections, which is an infection that affects any part of the urinary system, including the bladder, ureters, kidneys, and urethra. UTIs are most commonly caused by bacteria, such as *Escherichia coli* (E. coli), which is commonly found in the gastrointestinal tract.

Etiopathogenesis— It depends on several factors, including host factors, bacterial virulence factors, and anatomical and physiological factors.

Host factors— Factors that impair the immune response, such as immunosuppressive medications, HIV infection, or diabetes, can increase the risk of UTI. In addition, female anatomy (shorter urethra and closer proximity of urethral opening to the anus) makes women more prone to UTIs.

Bacterial virulence factors—Bacteria can produce virulence factors that help them colonize and infect the urinary tract. Examples of virulence factors include adhesins, which allow bacteria to adhere to host cells, and toxins, which damage host cells and promote bacterial survival.

Anatomical and physiological factors: The urinary tract is normally sterile, but certain anatomical and physiological factors can increase the risk of infection. These include obstructions to urine flow, such as kidney stones or an enlarged prostate, which can prevent complete emptying of the bladder, and urinary catheterization, which can introduce bacteria into the urinary tract.

Clinical manifestations.

- A strong, persistent urge to urinate.
- A burning sensation when urinating.
- Passing frequent, small amounts of urine.
- Cloudy or strong-smelling urine.
- Pain or discomfort in the lower abdomen or back.
- Fatigue or feverishness.

Pharmacological managements.

- Trimethoprim and sulfamethoxazole, Fosfomycin, nitrofurantoin, Cephalexin, Ceftriaxone, ofloxacin, ciprofloxacin, norfloxacin, amoxycillin etc.

Non-pharmacological managements.

- 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.

Hepatitis

Introduction.

Hepatitis is an inflammation of the liver that can be caused by a variety of factors, including viral infections, alcohol consumption, and autoimmune disorders.it is classified as—

Hepatitis A—It is typically transmitted through contaminated food or water, and symptoms include fatigue, nausea, vomiting, and jaundice. Most people recover within a few weeks without specific treatment.

Hepatitis B and C— These transmitted through blood and bodily fluids, and can lead to chronic infection, cirrhosis, and liver cancer. These types of hepatitis can be asymptomatic for years, and people may not realize they have the infection until liver damage has already occurred.

Hepatitis D— It is a rare form of hepatitis that only occurs in people who are already infected with hepatitis B. It can lead to severe liver damage and cirrhosis.

Etiopathogenesis.

The etiopathogenesis (causes and mechanisms) of hepatitis varies depending on the specific type of hepatitis. Common causes are-

1. Hepatitis A— Hepatitis A virus is a non-enveloped RNA virus that is primarily transmitted through the faecal-oral route, usually by ingestion of contaminated food or water. Once inside the body, HAV replicates in the liver and causes inflammation, which can lead to liver damage.
2. Hepatitis B— Hepatitis B virus is a partially double-stranded DNA virus that is transmitted through blood and bodily fluids. HBV enters liver cells and uses its own reverse transcriptase enzyme to create a DNA copy of its genome. This DNA can then integrate into the host cell's DNA, leading to chronic infection.
3. Hepatitis C: Hepatitis C virus is a single-stranded RNA virus that is also transmitted through blood and bodily fluids. HCV enters liver cells and replicates using host cell machinery. Like HBV, HCV can lead to chronic infection and liver damage.
4. Hepatitis D: Hepatitis D virus is a small, enveloped RNA virus that can only replicate in the presence of HBV.

Clinical manifestations.

- Jaundice.
- Weight loss.
- Lethargy.
- Hyporexia.
- Abdominal distension.
- Emesis/diarrhoea.
- Hepatoencephalopathy.
- Renal insufficiency haematuria.
- Ascites.

Pharmacological managements.

For hepatitis B- Interferon alpha, lamivudine, telbivudine, adenofovir, tenofovir, emtricitabine.

For hepatitis C- Ribavirin, boceprevir, imeprevir, sofosbuvir.

Non-pharmacological managements.

- Prevention of hepatitis involves good hygiene practices, such as hand-washing and safe food preparation, vaccination (for hepatitis A and B), and avoiding high-risk behaviours such as unprotected sex and sharing needles.
- Early diagnosis and treatment of hepatitis is important to prevent long-term liver damage and complications.

Gonorrhoea.

Introduction.

Gonorrhoea, also known as "the clap," is a sexually transmitted infection caused by the bacterium *Neisseria gonorrhoeae*. It can affect both men and women, and is spread through unprotected vaginal, anal, or oral sex with an infected person.

Etiopathogenesis.

- Gonorrhoea is primarily transmitted through sexual contact, including vaginal, anal, and oral sex with an infected person. The bacterium can enter the body through the mucous membranes of the genitals, rectum, or throat.

- When bacteria enter inside then uses pili and outer membrane proteins to adhere to and invade the epithelial cells lining the mucous membranes. This process involves binding to specific host cell receptors and activating bacterial enzymes that allow the bacterium to penetrate the host cell.
- The invasion of host cells bacteria triggers an inflammatory response, which can cause the symptoms of gonorrhoea.

Clinical manifestations.

- Painful or burning sensation during urination
- Increased vaginal or penile discharge
- Painful bowel movements or rectal itching
- Sore throat or swollen lymph nodes in the neck
- Painful or swollen testicles in men

Pharmacological managements.

- Penicillin G, benzathine P, doxycycline, cefixime, ceftriaxone, azithromycin.

Non-pharmacological managements.

- Prevention of gonorrhoea involves practicing safe sex, including using condoms correctly and consistently, limiting the number of sexual partners, and getting regular STI testing.
- Early diagnosis and treatment of gonorrhoea are important for preventing complications and reducing the risk of transmission.

Syphilis

Introduction.

Syphilis is a sexually transmitted infection caused by the bacterium *Treponema pallidum*. It can affect both men and women and is spread through vaginal, anal, or oral sex with an infected person. On the appearance of symptoms, it is categorized as-

1. Primary syphilis— Appearance of a painless sore, known as a chancre, at the site of infection. The sore may be on the genitals, anus, or mouth and typically lasts 3-6 weeks before disappearing.

2. Secondary syphilis— This characterized by a widespread rash that can appear all over the body, including the palms of the hands and soles of the feet. Other symptoms may include fever, swollen lymph nodes, sore throat, and fatigue.
3. Latent syphilis: This stage has no visible symptoms, but the infection persists and can be detected through blood tests.
4. Tertiary syphilis: This stage can occur years after the initial infection and can cause serious complications such as damage to the brain, nerves, eyes, heart, blood vessels, liver, and bones.

Etiopathogenesis.

- Syphilis is primarily transmitted through sexual contact, including vaginal, anal, and oral sex with an infected person. The bacterium can also be transmitted from a mother to her baby during pregnancy or childbirth.
- *Treponema pallidum* can enter the bloodstream and invade various tissues and organs. The bacterium uses its outer membrane proteins to adhere to and penetrate host cells, where it can evade the immune system and replicate.
- The invasion of host cells triggers the inflammatory response, which can cause the symptoms of syphilis such as the appearance of a chancre or rash.
- In some cases, untreated syphilis can progress to the tertiary stage, which can cause serious complications such as damage to the brain, nerves, eyes, heart, blood vessels, liver, and bones.

Clinical manifestations.

- Painful or burning sensation during urination
- Increased vaginal or penile discharge
- Painful bowel movements or rectal itching
- Sore throat or swollen lymph nodes in the neck
- Painful or swollen testicles in men

Pharmacological managements.

- Penicillin G, benzathine P, doxycycline, cefixime, ceftriaxone, azithromycin.

Non-pharmacological managements.

- Prevention of syphilis involves practicing safe sex, including using condoms correctly and consistently, limiting the number of sexual partners, and getting regular STI testing.
- Early diagnosis and treatment of syphilis are important for preventing complications and reducing the risk of transmission.

Malaria

Introduction.

- Plasmodium, a tiny protozoan is responsible for this disease. Different species of Plasmodium (P. vivax, P. malaria and P. falciparum) are responsible for different types of malaria. Of these, malignant malaria caused by Plasmodium falciparum is the most serious one and can even be fatal.
- It is transmitted in humans through the bites of infected female Anopheles mosquitoes (vector/transmitting agent). It is interesting to note that the malarial parasite requires two hosts – human and mosquitoes.

Etiopathogenesis.

- Plasmodium enters the human body as sporozoites (infectious form) through the bite of infected female Anopheles mosquito.
- The parasites initially multiply within the liver cells and then attack the red blood cells (RBCs) resulting in their rupture.
- The rupture of RBCs is associated with release of a toxic substance, hemozoin, which is responsible for the chill and high fever recurring every three to four days.
- When a female Anopheles mosquito bites an infected person, these parasites enter the mosquito's body and undergo further development. The parasites multiply within them to form sporozoites that are stored in their salivary glands.
- When these mosquitoes bite a human, the sporozoites are introduced into his/ her body, thereby initiating the events.

Clinical manifestations.

- Fever and headache.
- Fatigue and pain.
- Chill and sweating.
- Nausea and vomiting.
- Spleen enlargement.
- Kidney disfunction.

Pharmacological managements.

- Atovaquone-proguanil (Malarone)
- Quinine sulphate with doxycycline.
- Primaquine phosphate.

Non-pharmacological managements.

- Anopheles vectors are grown on the dirty place so, cleaning is very important.
- Follow the guidelines, release by the government.
- Take the balance diet and regular practice of yoga and exercise is very important.
- Use the mosquito net and mosquito repellent.

HIV

Introduction.

- HIV, or human immunodeficiency virus, is a virus that attacks the immune system and can lead to acquired immunodeficiency syndrome (AIDS). A widely used diagnostic test for AIDS is enzyme linked immuno-sorbent assay (ELISA).
- AIDS was first reported in 1981 and in the last twenty-five years or so, it has spread all over the world killing more than 25 million persons.
- AIDS is caused by the Human Immune deficiency Virus (HIV), a member of a group of viruses called retrovirus, which have an envelope enclosing the RNA genome. Transmission of HIV-infection generally occurs by

➢ Sexual contact with infected person.
➢ By transfusion of contaminated blood and blood products.
➢ By sharing infected needles as in the case of intravenous drug abusers.

- From infected mother to her child through placenta.

Etiopathogenesis— Infection spread in several stages.

- First pathogen enters in body through any route mention above then. The virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase.
- This viral DNA gets incorporated into host cell's DNA and directs the infected cells to produce virus particles.
- The macrophages continue to produce virus and, in this way, acts like a HIV factory. Simultaneously, HIV enters into helper T-lymphocytes (TH), replicates and produce progeny viruses.
- The progeny viruses released in the blood attack other helper T-lymphocytes. This is repeated leading to a progressive decrease in the number of helper-T lymphocytes in the body of the infected person. Due to decrease in the number of helper T lymphocytes, the person starts suffering from lots of infections (mycobacterium, viruses, fungi and even parasites like Toxoplasma).

Clinical manifestations.

- Fever and headache.
- Chills.
- Muscles aches and pains.
- Joint pain and fatigue.
- Swollen, lymph nodes mainly on the neck.
- Mouth ulcers and sore throat.
- Night sweat.
- Others infection also appears like skin disease etc.

Pharmacological managements.

- Abacavir, Emtricitabine, Lamivudine, Stavudine, Tenofovir, Zidovudine

Non-pharmacological managements.

- AIDS has no cure; prevention is the best option.
- Follow the all precaution (wearing the mask, sterilize the hand etc.) prior to any activities.
- Take the nutritious diet and make diet chart as per the instruction by the physician.

- Regular check-up and advice of physician is most important factor for the treatment of HIV.
- Follow the daily routine (sleep and awake) and try to practice regular yoga and pranayama.

Opportunistic infections.

Introduction.

- Opportunistic infections are infections that occur in people with weakened immune systems, such as those with HIV/AIDS, cancer, or who are taking immunosuppressive medications.
- These infections are caused by organisms that are normally harmless or even beneficial to healthy individuals, but can cause disease in people with compromised immune systems. Some common examples are-
  - **Tuberculosis.**
  - **Candidiasis.**
  - **Pneumocystis pneumonia.**
  - **Cytomegalovirus (CMV) infection.**
  - **Toxoplasmosis.**
  - **Cryptococcal meningitis.**
  - **Herpes simplex virus (HSV) infection.**

Prevention and treatments.

- Preventing opportunistic infections involves managing the underlying condition that is weakening the immune system and taking steps to prevent exposure to the infectious organisms. This may include taking antifungal, antiviral, or antibacterial medications, practicing good hygiene, and avoiding contact with people who are sick.

Viral Infections (SARS-CoV)

Introduction.

SARS, or severe acute respiratory syndrome, is a viral respiratory illness caused by the SARS coronavirus (SARS-CoV). The SARS outbreak occurred in 2002-2003, mainly in Asia, but cases were also reported in other parts of the world.

Etiopathogenesis.

- The SARS coronavirus (SARS-CoV) is primarily transmitted through close person-to-person contact, such as respiratory droplets produced when an infected person coughs or sneezes. The virus can also be transmitted through contact with contaminated surfaces or objects.
- Then it binds to angiotensin-converting enzyme 2 (ACE2) receptors on the surface of cells in the respiratory tract. This allows the virus to enter and infect the cells.
- The virus replicates and produces more SARS-CoV particles. This process leads to damage and inflammation in the respiratory tract, which can result in pneumonia and other respiratory symptoms.

Clinical manifestations.

- Fever, weariness, headache, stroke.
- Dyspnoea, rhinorrhoea, anosmia, ageusia.
- Dry cough, sputum production, sore throats.
- Acute respiratory distress syndrome.
- Lymphopenia.
- Acute cardiac injury.
- Pneumonia.
- Poor appetite, diarrhoea.
- Multiple organ failure.

Pharmacological managements.

- Remdesivir, Favipiravir, Hydroxychloroquine, Azithromycin, Lopinavir/Ritonavir, Nafamostat mesylate.

Non-pharmacological managements.

- Public health measures such as vaccination, social distancing, and wearing masks, which remain the most effective means of preventing the spread of viral disease.
- Take the balance diet and regular practice of yoga and exercise is very important.

Viral Infections (SARS-CoV2)

Introduction.

- CoV2, or SARS-CoV-2, is the virus responsible for the COVID-19 pandemic. COVID-19 is a respiratory illness caused by the SARS-CoV-2 virus, and it was first identified in Wuhan, China in December 2019
- Overall, the pathogenesis of SARS-CoV-2 is similar to that of other respiratory viruses, but the severity of COVID-19 can be influenced by a variety of factors, including the individual's age, health status, and immune response.

Etiopathogenesis.

- SARS-CoV-2 is primarily transmitted through close person-to-person contact, such as respiratory droplets produced when an infected person coughs or sneezes. The virus can also be transmitted through contact with contaminated surfaces or objects.
- Then it binds to angiotensin-converting enzyme 2 (ACE2) receptors on the surface of cells in the respiratory tract. This allows the virus to enter and infect the cells.
- The virus replicates and produces more SARS-CoV-2 particles. This process leads to damage and inflammation in the respiratory tract, which can result in pneumonia and other respiratory symptoms.

Clinical manifestations.

- Fever, weariness, headache, stroke.
- Dyspnoea, rhinorrhoea, anosmia, ageusia.
- Dry cough, sputum production, sore throats.
- Acute respiratory distress syndrome.
- Lymphopenia.
- Acute cardiac injury.
- Pneumonia.
- Poor appetite, diarrhoea.
- Multiple organ failure.

Pharmacological managements.

- Remdesivir, Favipiravir, Hydroxychloroquine, Azithromycin, Lopinavir/Ritonavir, Nafamostat mesylate.

Non-pharmacological managements.

- Public health measures such as vaccination, social distancing, and wearing masks, which remain the most effective means of preventing the spread of viral disease.
- Take the balance diet and regular practice of yoga and exercise is very important.