CHAPTER ONE
INFECTIOUS DISEASES

1. Introduction to infectious diseases

Generally infectious diseases result from bacteria, viruses, fungi, and parasites. Despite decades of dramatic progress in their treatment and prevention, infectious diseases remain a major cause of death and are responsible for worsening the living conditions of many millions of people around the world especially in the developing countries. Infections frequently challenge the clinician's diagnostic skill and must be considered in the differential diagnosis of syndromes affecting a multitude of organ systems. Infectious diseases often do not occur in isolated cases; rather they spread through a group exposed from a point source (e.g. a water supply contaminated with cholera) or from individual to individual (e.g. via respiratory droplets spreading tuberculosis). Many factors affect the likelihood of acquiring infections which include, host, environmental microbial factors.

Host and Environmental Factors

For any infectious process to occur, the parasite and the host must first encounter each other. Factors such as geography (e.g. altitude and malaria), environment (e.g. mosquito breeding site and malaria), disease vectors and host behavior (e.g. sexual behavior and sexually transmitted diseases) thus influence the likelihood of infection. Many **Host Factors** such as age, immunization, prior illness, nutritional status, pregnancy, coexisting illnesses and emotional status all have some impact on the risk of infection after exposure to a particular pathogen.

Medical care itself can increase the patient's risk of acquiring an infection. This can occur in several ways: through contact with the pathogens during hospitalization, through injections, surgical incisions, via mucosal surfaces by end tracheal tubes and bladder catheters, through the introduction of foreign bodies, through alteration of the natural flora with antibiotics, and through treatment with suppressive drugs such as steroids.

Microbial Factors

Infection involves complicated interaction of parasites and host and inevitably affects both. In most cases a pathogenic process consisting of several steps is required for the development of infections.

Since the competent host has a complex series of defense mechanisms in place to prevent infection, the successful parasite must utilize specific strategies at each of these steps. The specific strategies used by bacteria, viruses, and parasites have some similarities, but the details are unique not only for each class of organism but also for individual species within a class;

Invasion;

Microorganisms attached to mucosal surface use specific mechanisms to invade deeper structures. For example, meningococci and gonococci penetrate and traverse mucosal epithelial cells by transcytotic mechanism.

Tropism;

In order to infect a host successfully, many pathogens occupy highly specific place within the host and thus are tropic to a particular body site or cell type. For example, malaria sporozoites are rapidly cleared from the blood into the hepatocyts, where they undergo maturation and release into the circulation; trophozoites in turn can infect only the erythrocytes.

Microbial virulence strategies;

Microbes have developed a variety of strategies for escaping the immunity. For example, some pathogenic organisms elaborate toxins and enzymes that facilitate the invasion of the host and are often responsible for the disease state and many bacteria are encapsulated with polysaccharides that allow them to invade and deposit in the absence of specific antibodies.

Immune response:

Is a defense mechanism developed by the host for recognizing and responding to microorganisms. It is divided I to two major classes. Innate and Acquired Immunity.

Innate immunity (Natural Immunity):

Is first line of defense and serves to protect the host with out prior exposure to the infectious agent. This immune response is nonspecific and has no memory. Examples of Innate immunity include skin and mucous mebrane, phagocytoses by macrophages and nutrophils, complement system etc

Acquired (Adaptive) Immunity:

Is specific immune mechanism developed against a particular organism. It takes time to develop and it has long standing memory.

It has two major arms:

- **Cellular immunity**: comprising T- lymphocytes, NK cells
- **Humeral Immunity**: comprises of B-Lymphocytes and antibodies produced by plasma cells.

Laboratory diagnosis

The lab diagnosis of infections requires the demonstration, either

1. ***Direct*** microscopic visualization of pathogens in clinical material (e.g. Plasmodium species in blood films) or the growth of microorganisms in the laboratory (e.g. culture) or
2. ***Indirect*** (e.g. antibody / serology test for HIV), of viral, bacterial, mycotic, or parasitic agents in tissues, fluids, or excreta of the host.

Treatment;

Optimal therapy for infectious diseases requires a broad knowledge of medicine and careful clinical judgment. Life threatening infections such as bacterial meningitis and sepsis require urgent initiation of therapy often before a specific infective organism is identified. Antimicrobial agents must be chosen empirically and must be against the range of potential infectious agents consistent with the clinical condition. In contrast, good clinical judgment sometimes dictates withholding of antimicrobials in a self limited process or until a specific diagnosis is made. Certain infections (e.g. peritonitis, necrotizing fascitis, and abscess) require surgery as a primary means of cure; in these conditions, antibiotics play only as an adjunctive role.

References:

1. Kasper L., Braunwald E., Harrison's principles of Internal medicine, 16th Edition, Intruducion to infectious diseases, pages 695-700.

2. Acute Febrile Illnesses

2.1. Malaria

***Learning Objective**:* At the end of this unit the student will be able to

1) *Define Malaria*
2) *List the etiologies of the different types of malarias*
3) *Describe the mode of transmission & the life cycle of malaria*
4) *Mention the epidemiology of malaria.*
5) *Explain the pathogenesis malaria*
6) *Identify the clinical features of the different malarial diseases*
7) *List the common complications of malaria.*
8) *Describe the most commonly used tests for the diagnosis of malaria*
9) *Make an accurate diagnosis of malaria*
10) *Treat malaria at the primary care level with appropriate drugs*
11) *Design appropriate methods of prevention & control of malaria*

Definition

Malaria is a protozoal disease transmitted to man by the bite of the female anopheles mosquitoes.

Etiology of Malaria

Malaria is caused by the protozoan genus plasmodium. Four species are known to cause disease in man

P. falciparum: also called malignant malaria
P. vivax : tertian malaria
P. ovale : tertian malaria
P. malariae : quartan malaria

N.B. Almost all deaths are caused by falciparum malaria

Epidemiology of malaria

- Malaria is one of the commonest infectious diseases of man having a global distribution with prevalence of 500 million people affected every year and about 2 million people die of malaria/year. 40 % of the world population living in tropical/subtropical climates are exposed to malaria. The prevalence of malaria is increasing because of the emergence of DDT resistant Anopheles mosquitoes, drug resistant plasmodia and global whether changes.

- Malaria is common in both low and high land areas and epidemics are commonly observed in the latter with elevations between 1600 to 2150 meters during the months between September and December. The disease is prevalent in 75% of the country with over 40 million people at risk.
- All human malarial parasites are found in Ethiopia, but ***P. falciparum and P. vivax*** are the commonest, accounting for 60% and 40% respectively. However *P. ovale* and P*. malariae* account for less than 1% of all cases,
- Endemicity of malaria is defined based on ***spleenic rates*** (palpable spleen) in children between 2 & 9 years. Depending on this, regions are classified in to 4 endemicity areas:-
    - ***Hypo endemic*** - Where < 10% children have enlarged spleen
    - ***Meso-endemic*** - Where 10-50% children have enlarged spleen
    - ***Hyper-endemic*** - Where 51-75% of children have enlarged spleen
    - ***Holo-endemic*** - Where > 75% of children have enlarged "

- In **Holo**- and H**yper** endemic areas there is an intense transmission of ***P. falciparum*** people can sustain more than one infectious mosquito bit per day – people are infected repeatedly in their lives. Is such places, morbidity and mortality are considerable during childhood. Immunity against disease is hard won and during adulthood most infections are asymptomatic. This frequent round-year transmission is termed **Stable transmission**.
- In **Hypo** and **Meso** endemic areas the transmission of malaria is low, erratic or focal, full protective immunity is not acquired and symptomatic disease may occur at all ages .This is termed as **Unstable transmission**.