

## Infection and communicable diseases

Infection and the disease that result from it, is the greatest killer of humankind. Infection is interaction between human body and another organism usually microscopic, the immune system of human is combat and prevent the infection, all body tissues are susceptible to infection.

Infectious agents :

- 1- Prions : It is single protein infecting human usually from human cadaver organ transplant .
- 2- Viruses : Microorganisms formed of protein and nucleic acid either RNA or DNA it can't reproduce autonomously ,it need to enter the prokaryotic or eukaryotic cells to divert the intracellular mechanism for viral replication .
- 3- Bacteria : It is a prokaryotic microorganisms that contains both RNA and DNA has ability to metabolize protein has no nuclei ,it reproduce autonomously can live freely although *Chlamydia* and rickettsia (obligatory intracellular) in addition to these The bacteria include cocci ,bacilli ,mycoplasma ,spirochetes and *Actinomyces* .
- 4- Eukaryotes : These microorganisms is sub cellular compartmentalisation with intracellular function achieved by specific organelles like nucleus ,chromoplast, mitochondria and Golgi apparatus .The eukaryotes involved in human infection includes the fungi ,protozoa and parasitic worms(helminthes) .

## Epidemiology of infection

Infection in developed countries : The incidence of infection has dramatically improved in these countries now due to improved nutrition ,sanitation ,housing ,immunization and improved antibiotics although new infection appeared like HIV and remerge of drug resistant tuberculosis .

Infection in tropical countries : In less developed countries infection is one of the common cause of disability and mortality especially in children as it constitute 40% of mortality . Infections may be chronic leads to organ damage like liver and kidneys in schistosomiasis ,heart in trypanosomiasis cruzi .lungs, lymph nodes and bones in Tuberculosis and bone marrow as reserves for malaria . There are frequent outbreaks like cholera and meningococcal meningitis which cause mortality to hundred thousands of people .So active action need to control disease and vector of carrier like malaria and its carrier mosquito ....etc . Need vaccination against poliomyelitis ,measles ,rubella ,meningitis, tetanus and hepatitis A and B . and education of the people ,improved sanitation and nutrition .

## Sources and spread of infection

The sources of infection are :

A- human reservoirs : Endogenous infection originate from human from nasopharynx , skin ,colon or exogenous from other human infected or carrier to the microorganism .

B- Animal reservoirs : infection directly from animal to human (zoo noses) through contaminated meat like food poisoning ...etc .Through milk like tuberculosis or brucellosis .Through body fluids like urine(Leptospirosis) ,saliva (rabies) or through bird faeces (psittacosis) .

C- Environmental reservoirs : By air droplets like Legionella or through water like typhoid fever ,cholera and hepatitis A ,or through soil like spores of clostridia (tetanus or anthrax ) .

Transmission of infection :

1-Endogenous: From human body like from colon to peritoneum or from oral cavity or colon to endocardium .

2-Exogenous : The causes are human source ,animal source and environmental sources .

Microorganism – Host interaction :

Infection affect the body in many ways either acute ,chronic ,allergic or toxic .

- 1- Acute infection presented as fever ,anorexia, protein catabolism ,negative nitrogen balance ,acute phase proteins ,anemia ,neutrophilia , inflammation ,convulsion usually in children ,confusion usually in elderly ,shock ,hemorrhage and organs failure .
- 2- Chronic : Presented as weight loss ,muscle wasting ,malnutrition ,chronic anemia , growth retardation and delayed development , tissue destruction as lung damage in tuberculosis and post infection syndrome like depression , fatigue ,irritable bowel syndrome .
- 3- Allergic (immune mediated ) : Presented as rash , erythema nodosum ,arthritis , encephalitis ,peripheral neuritis ,hemolytic anemia and nephritis .
- 4- Toxic (toxin –mediated ) : Presented as erythematous rash in streptococcal infection , toxic shock syndrome in staphylococcal and streptococcal infection , diarrhea in staphylococcal infection ,organ disturbances in diphtheria and neurological in tetanus and diphtheria .

Incubation period : The time from microorganism invading the body till appearance of the clinical features of infection it classified into short incubation period less than 7 days ,intermediate incubation period 7- 21 days and long incubation period more than 21 days .

Infectivity period : The time at which the patient is infectious to other people .

## Investigation of infection

Is to prove infection and causative factor by :

- 1- Prove infection by non specific marker of inflammation or infection like leucocytosis either neutrophilia or lymphocytosis ,increase erythrocyte sedimentation rate (ESR) ,C-reactive protein ,procalcitonin ,increase cell count in urine or cerebrospinal fluid .
- 2- Direct detection of microorganism by :
  - a- Microscopy : Detection of microorganism from body fluid ,tissue using Bright field microscopy for Gram 'stain for bacteria , Ziehl –Neelsen stain and auramin stain for tuberculosis . Dark field microscopy like for detection of syphilis bacteria . Electron microscopy is used for viral and other microorganism not detected by above measures but now supplanted by nucleic acid detection .
  - b- Detection of organism compound : Part of the microorganism is detect to indicate the presence of that microorganism like nucleic acid ,cell wall component or toxin . Like Legionella pneumophila antigen in urine , Clostridia difficile toxin in stool .
  - c- Nucleic acid amplification test (NAAT) : Specific sequence of microbial DNA or RNA is amplified exponentially called primer and the amplification method called polymerase chain reaction (PCR) there are Real time PCR used to detect viral RNA like hepatitis C and HIV 1 and multiplex PCR to detect many microorganism in one assay . PCR can diagnose bacteria ,viruses ,fungi and parasites using blood ,saliva ,body fluids ,urine ,stool or tissues . Now it is used supplanted the electron microscopy .
- 3- Cultures : Body fluids and tissues can be used for cultures either in
  - a- In vivo culture not used routinely .
  - b- Ex vivo culture (using cell or tissue for culture) used for viruses now replaced by PCR .
  - c- In vitro culture using artificial medias including blood culture media .
- 4- Test of human specific immune response : Antibody detection and Interferon –  $\gamma$  release assay (IGRA) the later is specific for tuberculosis .

## Management of infection

- 1- Treatment of patient .
- 2- Treatment of contact patients .
- 3- Prevention of infection by immunization passive and active immunization.
- 4- Treatment and prevention of outbreak .

Each subject will be discussed in detail in the relevant subjects .