



## CAUSES OF DISEASE / DISEASE AGENTS

Disease agent is an organism, substances force or disturbance which causes disease due to excessive presence, deficiency or absence

## 1. Pathogens / Biological agents

They are biological entities which causes infectious disease. Example virus ( mumps, chicken pox, small pox), mycoplasma ( acute leukemia, bronchitis), Chlamydia ( trachoma) rickettsia ( typhus, trench fever ), bacteria ( cholera, tetanus), spirochaetes ( syphilis) ,fungi ( ringworm, thrush, moniliasis, pulmonary aspergillosis), protozoa (giardiasis, sleeping sickness), helminths ( filariasis, ascariasis, taeniasis), other organisms (scabies)

## 2. Nutrient agents

Deficiency of vitamins ( beri-beri, scurvy, night blindness), minerals ( anemia, rickets), carbohydrates, fats and protein ( maramus, kwashiorkor) or excess of food ( obesity)

## 3. Chemical agents

- (i) Endogenous: Excess presence of urea and uric acid, reduced secretion of ADH ( diabetes insipidus) or insulin ( diabetes mellitus)
- (ii) Exogenous : Pollutants( pneumoconiosis) allergens ( allergy)

## 4. Physical agents

Heat ( e.g. stroke), cold (frost bite), radiations, sound ( impaired hearing , electricity, pressure, humidity etc.

## 5. Mechanical Agents

Fractures, sprains, dislocations, injury, chronic friction

## 6. Genetic agents

Excess or deficiency of chromosomes, mutations harmful alleles e.g. colour blindness, albinism. Haemophilia, Turner's syndrome

## 7. Degeneration

They include old age change like peptic ulcers, hypertension, atherosclerosis

## 8. Social and personal inconsistencies: They lead to mental disorder.

## INFECTION

Infection is invasion, establishment and growth of pathogens in a host contamination is occurrence of harmful organism or their products in articles of use. E.g. milk, food, water, garments. Infestation is occurrence of animal parasites or ectoparasites like lice on or inside the body of an individual.

## KOCH'S POSTULATES

Robert Koch studied diseases and pathogens of anthrax ( *Bacillus anthracis*) in 1876, tuberculosis ( *mycobacterium tuberculosis* ) in 18982 and cholera ( *vibrio choleras* ) in 1883. He gave forth germ theory of disease and proposed four criteria for establishing an agent of infectious disease. They are called Koch's postulates

1. Pathogenic organism occurs in abundance in patients suffering from diseases.
2. Pathogen can be separated and cultured.
3. Healthy persons injected and cultured pathogen contracts disease.
4. Pathogenic organism is recoverable from the newly diseased individual.

However, viruses cannot be grown in pure artificial cultures.

#### RESERVOIR OF INFECTION

It is the place or organism where a pathogen resides without causing any infection e.g. air, soil, water, animals ( reservoir hosts ) and some human beings called carrier. Carrier is an animal or healthy human host which harbor the pathogen without being harmed and passes the same to another susceptible individual. Many cook passed typhoid to several thousand individuals. She has been appropriately called typhoid Mary.

#### TRANSMISSION OF INFECTIOUS DISEASE

##### 1. Direct Transmission

An intermediate agent is absent

- i) Direct contact with infected persons. The diseases are called contagious e.g. ringworm, syphilis
- ii) Droplet Infection: Transmission is from an infected person to healthy person in mist emitted from nose, lungs and mouth while sneezing, splitting, talking and coughing. E.g. influenza, common cold and diphtheria.
- iii) Contact with soil: Soil born pathogens enter the host through injured or exposed part. E.g tetanus
- iv) Animal bite: Rabies is spread through bite of dog / cat
- v) Transplacental Transmission: Mother transfer virus of German measles and bacterium of syphilis through placenta.

##### 2. Indirect Transmission:

An intermediate agent is required

- i) Vectors : Vectors are living agent for transferring pathogens e.g. housefly, mosquito, tse-tse fly, sandfly. Mosquitoes are vectors of

malaria, encephalities, filarial, yellow fever, dengue etc. Housefly is vector of cholera, dysentery, typhoid, diarrhea, conjunctivitis.

- ii) Vehicle born: An article of food, water ice carries the pathogen for transmission e.g. cholera, typhoid, dysentery.
- iii) Air borne: Dust and air current spreads disease.
- iv) Tomite borne: Articles handled or coming in contact with patients are cause of disease transmission, e.g. door handles, taps, crockery, currency, garments.
- v) Unclean hands: They transfer germs to healthy person, food, utensils etc.

### RESISTANCE TO INFECTION

Every pathogen has a specific portal of entry into the body. Invasiveness of a pathogen is its ability to gain entry into host and grow. Virulence is the ability of pathogen to produce disease.

Toxigenicity is power of a pathogen to form toxins capable of damaging host cells. Degree of virulence depends upon invasiveness and toxigenicity. Infective dose is the maximum number of pathogenic organism that can result in the production of disease. Infection depends upon the presence of infective dose, virulence of pathogen, natural resistance and immunity. Host has three line of defense against invasion by pathogens. They are nonspecific and specific defense mechanism

### VIRAL DISEASES

#### VIRAL HEPATITIS

- Viral hepatitis is commonly called jaundice viral hepatitis is common in Eastern Europe, Africa and Asia. In early stage the liver is enlarged and congested. In later stage the liver becomes small, yellowish or green
- The symptoms in early phase includes-fever, anorexia, nausea, vomiting, epigastric discomfort pains in muscles and joints
- The urine is dark and stool is pale. Leukopenia is followed by lymphocytosis. Splenic enlargement is sometimes present. Jaundice increases for 1-2 weeks
- There are six varieties of hepatitis. These are Hepatitis A, known as infectious hepatitis is a benign. Usually it is not fatal but in rare case its fatal rate is 0.1%. It is spread by ingestion of contaminated water and food
- Hepatitis B, called as serum hepatitis is versatile one. Blood and body secretions such as saliva, sweat, semen, tears, breast milk are vehicle of transmission

- Hepatitis C has been known to cause 90 to 95% of cases of transfusion associated hepatitis.
- Hepatitis D, called delta hepatitis. HDV is defective virus for which HBV is the helper. Thus, hepatitis D develops when there is concomitant hepatitis B infection
- Hepatitis E, is an enterically transmitted and is water born infection. A characteristic feature of hepatitis E infection is the high mortality rate among pregnant women
- Hepatitis G is caused by hepatitis GB virus

Preventive measures

The control measures for infectious hepatitis are

- ✓ Sanitary disposal of excreta
- ✓ Prevention of contamination of water, food and milk
- ✓ Control of flies
- ✓ Screening of kitchens and latrines
- ✓ Personal cleanliness and also that of food handlers
- During epidemic,, boiled or chlorinated water should be taken
- To control semen hepatitis, person having hepatitis should not be accepted as blood donors pregnant women having serum hepatitis can transmit the disease to infants.

## DENGUE FEVER

- Dengue fever is caused by an RNA containing arbo virus of feavi virus group which also causes yellow fever. Thus, the virus which causes dengue fever is a mosquito born flavi-ribo virus
- The virus of dengue fever is transmitted by the bite of tiger mosquito, *Aedes aegypti* during day time. *Aedes aegypti* is primarily a day time feeder and mainly bites in the morning or late in the afternoon in covered areas. The *Aedes aegypti* female prefers to lay its eggs in artificial, rather than natural containers, that have fairly clean water and are located around human habitation
- Incubation period is 3-8 days

Classical dengue fever

- It is an acute viral infection caused by at least 4 stereotypes of dengue virus. The reservoir of infection is both man and mosquito. The transmission cycle is

man-mosquito-man. *Aedes aegypti* is the main vector. The illness is characterized by an incubation period of 3 to 10 days

#### Symptoms

- (i) Abrupt onset of high fever
- (ii) Several frontal headache
- (iii) Pain behind the eyes which worsens with eye movement
- (iv) Muscle and joint pains
- (v) Loss of sense of taste and appetite
- (vi) Measles like rash over chest and upper limbs
- (vii) Nausea and vomiting

#### Dengue haemorrhagic fever

- Dengue haemorrhagic fever ( DHF) is a severe form of dengue fever, caused by infection with more than one dengue virus. The severe illness is thought to be due to double infection with dengue viruses – the first infection probably sensitizes the patient, which the second appear to produce an immunological catastrophe

#### Symptoms

- (i) Bleeding from the nose, mouth, gums and skin bruising
- (ii) Sever and continuous stomach pains
- (iii) Frequent vomiting with or without blood
- (iv) Pale cold or clammy skin
- (v) Excessive thirst ( dry mouth)
- (vi) Rapid weak pulse
- (vii) Difficulty in breathing
- (viii) Restlessness and constant crying

#### Prevention

- No vaccine for dengue fever is available. Eliminate mosquito breeding places by covering small water containers, water tanks, changing the water of cooler every week and where *Aedes* mosquito breed. Wear cloths which cover arms and legs. Use mosquito repellents, repellent cream and sleep in mosquito – net

#### YELLOW FEVER

- Yellow fever is a zoonotic disease caused by an arbovirus. It is a haemorrhagic disease transmitted by an infected *Aedes aegypti*. It affects principally monkeys and other vertebrates in tropical America and Africa.
- Yellow fever is characterized by headache, fever, vomiting, rupture of veins in kidney, spleen, liver, etc. In severe cases, the skin of the sufferer becomes yellow from jaundice, hence the name yellow fever
- Max Theilder in 1951 got Nobel Prize for the development of vaccine for yellow fever

#### CHIKUNGUNYA

- It is a temporarily debilitating disease caused by Alpha virus and spread through mosquitoes, *Aedes aegypti* and *Aedes albopictus*
- Symptoms
- The patient has maculopapular ( strain and eruptions) rash of limbs and trunk and arthritis of multiple joints
  - There is fever which lasts for about two days which is accompanied by conjunctivitis and photophobia. Even after disappearance of fever, headache, insomnia and arthritis continue for 5-7 days

#### Treatment

- Chloroquine phosphate has been found to reduce the impact of the disease.

#### Prophylaxis

Protection against *Aedes* mosquitoes by use of long sleeves, full pants, socks, windows and doors with wire gauze screens and mosquito repellents are preventive measures. There should be no stagnant water nearby

#### COMMON COLD

- Common cold is caused by 100 types of Rhino virus and small bacterium *Dialister pneumosintes*

#### Symptoms

- Virus infects nose and upper respiratory passage causing inflammation of mucous membranes
- There is irritation of nasal tract, nasal congestion, flow of mucus, sneezing, sore throat, hoarseness, cough, tiredness, head ache and slight fever

Treatment : It cures automatically after 3-7 days

## MUMPS

- Mumps is caused by Paramyxovirus ( RNA virus) or myxovirus parotiditis. Virus generally affects the children between the age of 5 and 12 years
- It is highly infectious and spreads through droplet infection or direct contact with the mucus membranes of mouth.
- Incubation period is about 12-26 days

## Symptoms

- Mumps causes inflammation of the parotid glands behind ears. It also affects testes and ovaries in adults leading to sterility.

## Treatment

- One attack gives a lifelong immunity
- There is no specific medicine for mumps
- MMR vaccine is used against measles, mumps and German measles ( rubella)

## MEASLES ( Rubeola disease)

- Measles is highly infectious childhood disease occurring between 3-6 years of age
- It is caused by Rubeola virus which is passed out in the secretions of nose and throat of the infected person as droplets or in articles soiled by these secretions. The incubation period is of 10days

## Symptoms

- Eruptions of small spots in the form of rash all over on face and body along with itching
- Inflammation of respiratory passage from mouth to bronchi, sometimes may effect conjunctiva

## Treatment

- Single attack gives a lifelong immunity
- Edmonston B vaccination is also available to provide active immunity
- Antibiotics and sulpha drugs are effective in measles

## CHICKEN POX

- Chicken pox is caused by Varicella zoster virus a DNA virus, which is passed out in the discharges of the respiratory tract of the infected person directly as droplets or through contaminated articles used by the patient.
- Incubation period is of 14-21 days

## Symptoms



- Dew-drop like rash ( pox) at stomach and chest, spreading later on face and the whole body characterize it. Also high fever, itching, aches and uneasiness occurs  
Treatment
- Boric acid, calamine and benzyl benzoate reduces itching and tendency to scratch.
- One attack give a lifelong immunity
- No vaccine available so far

#### SMALL POX

- It is an eruptive viral disease which has been completely eradicated through widespread compulsory vaccination. The last case was reported in Somalia in 1977.
- WHO declared the planet free from small pox in 1980. The disease is caused by brick shaped DNA virus called Variola Virus
- Infection starts from oral, nasal, vesicular discharges, pustules and scabs. Incubation period is 12 days

#### Symptoms

- The disease begins with headache, backache, chill, high fever, rashes appearing on third day of illness as reddish spots which change in to papules and finally scabs in third week
- The spots appear first on the hair line, then face and over rest of the body but fewer on the trunk. The scab fall down leaving permanent pox mark, complications include blindness
- Death could occur

#### Treatment

Vaccine for small pox was developed by Edward Jenner and gives active immunity

#### TRACHOMA

- Trachoma is caused by chlamydia trachomatis.
- It is spread through direct contact with the discharge from infected eyes.
- It causes ulceration of cornea and conjunctiva of the eye.
- In acute case it lead to blindness.

#### Symptoms

- It is caused by development of granules.
- There is inflammation pain and watering of the eye.

#### Treatment

Sulpha drug and specific antibiotics help to cure the disease

### POLIMYELITIS

- Poliomyelitis is caused by enterovirus, polio virus ( RNA virus ) who is 10 $\mu$ m in diameter
- It enters the body through food and water and multiplies in the cells of the intestinal wall and spreads in nervous system through blood
- Incubation period is 7-14 days

#### Symptoms

- It produces inflammation of the nervous system
- There is inability of bending the head forward stiffness of neck, paralysis of skeletal muscles, fever, headache, chilliness and pain all over the body

#### Treatment

- Oral polio drops on 6<sup>th</sup> , 10<sup>th</sup> and 14<sup>th</sup> week of the child.
- Booster shots before the age of 3 and 4 years give immunity
- A person who recovers from polio has a life time immunity
- Vaccine for polio are killed Salk's vaccine and live Sabin's oral vaccine

### INFLUENZA ( FLU)

- Orthomyxo virus, a spherical RNA virus having a lipid envelope causes influenza
- Influenza is epidemic, endemic and pandemic
- Endemic influenza is caused by Haemophilus, influenza, a gram ( - )ve bacteria
- Avian flu is a viral disease caused by H5N1 virus, first reported in China
- Incubation period is 18 hours to 72 hours

#### Symptoms

It is characterized by discharge from the nose, sneezing, sore throat, cough, muscle pain, headache, chill and fever for 4-5 days.

#### Treatment

Vaccination is available but a high risk

### RABIES ( Hydrophobia )

- Rabies is primarily a disease of carnivores like dogs, cats etc. It is caused by Rabies Virus ( Rhabdo virus or Lyssa Virus )
- It enters human body with saliva of an infected animal generally by bite or scratch of dog or a cat
- The virus destroys the brain and spinal cord

#### Symptoms

- It is characterized by scare of water in victim and biting behaviors. Other symptoms are anxiety, irritability, fatigue, loss of appetite, sensitivity to light and sound, saliva from the mouth, headache, fever and inability to swallow fluids due to chocking throat

#### Treatment

Treatment of rabies was discovered by Louis Pasture. It involves a series of 14 injections given after the bite of dog. It is antirabies serum.

July 6 is marked as world Rabies Day

### BACTERIAL DISEASES

#### TUBERCULOSIS OR T.B.

- T.B. is caused by mycobacterium tuberculosis and infects any part of the body. It could be bones, brain or lungs and lymph nodes. Lung T.B. is most common. The bacterium releases a toxin tuberculin which destroy tissues it infects
- It spreads through sneezing, coughing, contaminated food water or cloths
- Incubation period is 3 to 6 weeks or may be years

#### Symptoms

- Constant cough and in severe cases sputum wille blood, pain in chest. While coughing, loss of body weight and gradual weakening of the body, low grade fever throughout the day are the symptoms of lungs T.B.

#### Treatment

- Sputum, tuberculin, X-rays and gastric analysis are carried out to diagnose tuberculosis

- Direct observation treatment ( DOT) is a programme under WHO for treatment of T.B. across the world
- Some of the antituberculosis drugs are streptomycin, rifampicin, isoniazid, thiatozone, PAS ( Paraamino salicylic acid) etc.
- BCG ( Bacillus Clamette Guerin) vaccine for T.B. was obtained from bovine bacillus by Calmette and Guerin in 1921

#### DIPHThERIA

- It is an acute infectious disease produced by gram (+) rod-shaped bacterium corynebacterium diphtheria
- Diphtheria has three forms-gravis, intermedius and mitis. Infection occurs mostly in children of 2-5 years
- It is spread through droplets method by kissing, coughing, sneezing and contaminated articles
- Incubation period is 2-5 days
- Portal of entry is upper respiratory tract through implantation may occur anywhere.
- Exotoxin produced by pathogen causes epithelial necrosis of nose ( nasal diphtheria ), throat tonsils ( pharyngeal diphtheria) and laryngotrachea ( laryngotracheal diphtheria)

#### Symptoms

- Fever, sore throat, epithelial necrosis by endotoxin and oozing of semi-solid material in the throat which develops into a grey false but tough membrane
- The membrane chocks the air passage sometimes, bacterium infects the heart leading to fatal heart blockage

#### Treatment

- Schick test the presence of antitoxin and the sate of hypersensitivity to diphtheria toxin
- Diphtheria antitoxin can neutralize the toxins produced only if given within 24 hours of appearance of symptoms.
- DPT- vaccine: Diphtheria, pertussis and tetanus vaccine is given as immunization within six weeks of birth.

#### WHOOPING COUGH OR PERTUSIS

- Whooping cough is caused by Gram (-) non motile coccus *Bordetella pertussis* is a common childhood disease affecting the respiratory system
- It spreads by droplet infection or by direct contact.
- It has an incubation period of 1-16 days

#### Symptoms

- It causes constant cough leaving the child breathless, tired and red in face
- Later the voice becomes hoarse and the cough gives a whoop or loud crowing sound while inhaling
- The child usually vomits and there is frothy discharge from his mouth and nose

#### Treatment

- Immunization of disease is done by DPT vaccination within six weeks of birth. Three doses at one month interval at the age of 3 to 4 month

#### CHOLERA

- Cholera is water borne disease
- This is caused by the bacterium *Vibrio cholerae* or comma infecting intestines and digestive tract
- It is spread through contaminated food and drinks
- The causative bacterium secretes cholera toxin enterotoxin which induces excessive secretion of an isotonic electrolyte solution by the intestinal mucosa
- Incubation period varies from a few hours to 2-3 days

#### Symptoms

- Cholera is mainly characterized by sudden onset of profuse, effortless, rice-water like stools, vomiting and rapid dehydration, loss of minerals and muscular cramps

#### Treatment

- Fluid and salt lost is restored by Oral Rehydration Solution (ORS). It is water with a small amount of sugar and salt
- Cholera vaccine is effective for six months only

#### Prophylaxis

- Proper sanitation and hygienic conditions are the best methods of prevention

## DIARRHOEAL DISEASES

- Diarrhoeal diseases are a group of diseases caused by different bacteria e.g. E.coli, shigella, campylobacter, salmonella, clostridium.
- This is spread through food poisoning, contaminated food, water or drinks, clothes, utensils and bed sheets.
- Incubation period is variable.

## Symptoms

- This is characterized by mild diarrhea. i.e loose stools if infected by E.Coli, frequent stool with blood and mucus and abdominal cramps if infected by shigella, dehydration, diminished appetite, fever, lower B.P., increase in pulse rate, etc

## Treatment

- ORS is given repeatedly to check dehydration and loss of minerals.

## Prophylaxis

- Proper sanitation and hygiene are needed for prevention

## LEPROSY ( HANSEN'S DISEASE)

- Mycobacterium leprae causes this dreaded disease.
- Presence of lepranin in skin test, can indicate the appearance of leprosy. It spreads through contact with infected person
- Its incubation period is up to five years
- It is of two types
  - (i) Tuberculoid leprosy involving tuberculoid granulomas formed by aggregation of macrophages
  - (ii) Lepromatous leprosy characterized by modular aggregates of lipid laden macrophages, lepra cells.
- Lepromatous leprosy gives positive test with lepromin while tuberculoid leprosy is negative lepromin test.

## Symptoms

- It is characterized by the chronic infection of skin and other tissues including nerves and wasting of body parts, formation of ulcers, nodules, scales,

deformities of fingers, toes making the infected parts senseless or numb and hypopigmentation of skin

#### Treatment

- Surgery along with drugs diaminodiphenyl sulphone or dapsone, ofloxacin, chaulmoogra oil can cure the disease

#### TETANUS ( LOCK JAW )

- It is an incurable bacterial disease ( Clostridium tetani ) characterized by painful muscular contraction of jaw. The incidence its occurrence is quite common in India with high mortality in infants and mothers
- The bacterium occurs in intestine of horse and other animals from where they pass out as spores in their excreta that mixes in street dust and contaminates various articles including rusted iron. Wounds and cuts, surgical instruments coming in contact with road dust may caused the entry of spores into body
- The bacteria are released inside the body. They multiply and begins to secrete a toxin named tetanospasmin
- Incubation period is 3-28 days.

#### Symptoms

- Disease is caused by tetanospasmin reaching the CNS. It begins with headache, chill irritability followed by back pain, stiff neck and spasm of jaw, ultimately there is lock jaw, spasm of chest, abdomen and spine leading to death due heart failure suffocation and exhaustion

#### TYPHOID

- Salmonella typhi, a rod like bacterium causes this contagious disease of intestines.
- The organisms of the disease are present in stools and urine, therefore, carried by contaminated water and food
- Incubation period of the bacterium is 1-3 weeks

#### Symptoms

- This disease is characterized by the inflammation of ileum and colon, liver and spleen also becomes enlarged, abdominal pain, constant fever, extreme weakness, vomiting, rash of rose coloured spots called rose spot on the upper abdomen and sore throat.

## Treatment

- Typhoid is diagnosed by Widal test.
- Typhoid vaccines ( TAB vaccine) provide immunity for about three years
- Antibiotic like ampicillin and chlor amphenicol.
- Resistant cases are treated with quinoline derivative e.g. ofloxacin, ciproflaxacin.
- Surgical removal of gall bladder ( cholecystectomy) is carried out on the carriers in order to remove source of infection because the bacterium remain concentrated in gall bladder in carriers.

## PNEUMONIA

- Pneumonia is a serious disease of lungs characterized by accumulation of mucus / fluid in alveoli and bronchioles to that extent the breathing becomes difficult
- It is caused by strepto coccus pneumonia or Diplococcus pneumoniae, have an incubation period of 1-3 days.
- It is spread through sputum of the patient.
- It is of two types
  - i) Bronchopneumonia in young children and elderly persons
  - ii) Lobarpneumonia in 10 -15 year old

## Symptoms

- The onset of pneumonia is usually sudden with a single shaking chill, followed by fever pain with breathing on the side of lung involved, increased pulse and respiratory rates and cough. Sputum is bloody or rusty

## Treatment

- Drugs against pneumonia are tetracycline, erythromycin and sulphonamide. If untreated pneumonia leads to death

## PLAGUE ( BLACK DEATH )

- Plague is caused by a rod shaped non-motile bacterium called Pasteurella / Yersinia pestis transmitted by the bite of infected rat flea Xenopsylla cheopis. This disease kills the rats. Rat flea leave the dead rats and attack humans. The death of rats is an indication of outbreak of plague
- It is of three types



- i) Bubonic plague ( black death) having an incubation period of 2-6 days. Pathogen multiplies in lymph nodes, especially armpit and groin which swell up into painful buboes. Other symptoms are high fever, chill, delirium, exhaustion and haemorrhages which turn black. The patient dies there after. Hence, plague is also called black death
- ii) Septicemic plague – In this, buboes do not occur. It is characterised by sepsis, sever headache, rapid pulse, fever, chill, nausea, vomiting and rapid pulse, fever, chill, nausea, vomiting and delirium leading to death within two days
- iii) Peneumatic or Pneumonic plague – It infects lungs causing pulmonary edema, fever, anoxia, delirium and death within twenty four hours.

#### Treatment and prevention

- Streptomycin or oral tetracycline is effective against plaque. Anti-plague vaccine, spray of insecticides, killing of rats, nose caps and high cots are some preventive measure

#### PROTOZOAN DISEASES

##### AMOEBIASIS OR AMOEBIC DYSENTERY

- Amoebiasis disease is protozoan infection of upper part of large intestine which is caused by monogenic protozoan known as Entamoeba histolytica
- The infection is by the cysts of Entamoeba present in the stool of infected person, cat, dog, monkey, rat, rabbit etc. through the agency of house flies, manure, air currents, number of other physical contacts and unsafe drinking water.
- Inside the intestine, the cyst germinates and releases 4-8 entamolbae. The parasites secrete an enzyme called cytolysin that partially dissolves the wall of large intestine
- The parasites reach blood capillaries and feed on red blood corpuscles.
- When the infection is sever, the parasites pass into blood stream and enter various body organs. The most commonly affected organs are liver, lungs, spleen and brain. These organs comes to have pus filled absecesses
- The feeding stage of a parasite is called trophozite or magna form ( 30 $\mu$  ). It stops feeding per-cystive stage is called minuta form ( 7-20 $\mu$  ).

#### Symptoms

- Amoebiasis disease is characterized by abdominal pain, mild diarrhea alternating with constipation, passing out of mucus, pieces of necrotic mucous membrane and blood in faeces, and faeces with cysts and charcot –Leydon white crystals.

#### Treatment

- This can be cured by administering drugs like, emetine, stremetine, carbosome, metronidazole and tinidazole.

#### Prophylaxis

- Disease can be prevented by proper sanitation with proper kitchen, protection of food from flies, proper washing of vegetables, health education etc.

#### MALARIA

- Malaria is caused by a digenetic ( have two hosts to complete its life cycle) and triphasic ( having three phases of life cycle) protozoan parasites known as plasmodium
- There are four species of Plasmodium which causes four main types of malaria in human they are:
  - i) Plasmodium vivax – Benign tertian malaria in which fever recurs after every 48 hours
  - ii) P. malarie – Quartan malaria in which fever appears after 72 hours and often produces persistent subclinical malaria
  - iii) P. falciparum – Cerebral malaria or malignant tertian malaria where fever recurs in every 48 hours
- The parasite has two hosts:
  - (i) Primary host or definitive host – female Anopheles mosquito
  - (ii) Secondary or intermediate host – man
- The infective stage of parasite in human begins is sporozoite
- The incubation period of Plasmodium ovale and P.Vivax is 10-15 days, 6-12 days for Plasmodium falciparum and 28-30 days for P.malariae
- Sporozoites are introduced in human being by the bite of female anopheles mosquito and then the sporozoites undergo multiplication in different stages – pre-erythrocytic schizogony, exoerythrocytic schizogony, erythrocytic schizogony and post –erythrocytic schizogony. Only erythrocytic schizogony occurs in case of P.falciparum

- Erythrocytic schizogony occurs inside red blood corpuscles or erythrocytes, It occurs in repeated cycles. Infected red blood corpuscles are destroyed and melanin or haemozoin particles are released. They are toxic and cause rigor. The parasites present in red blood corpuscles ultimately form gametocytes. The gametocytes are sucked by female Anopheles. Inside the mosquito the fertilization and development takes place to form sporozoites.

#### Symptoms

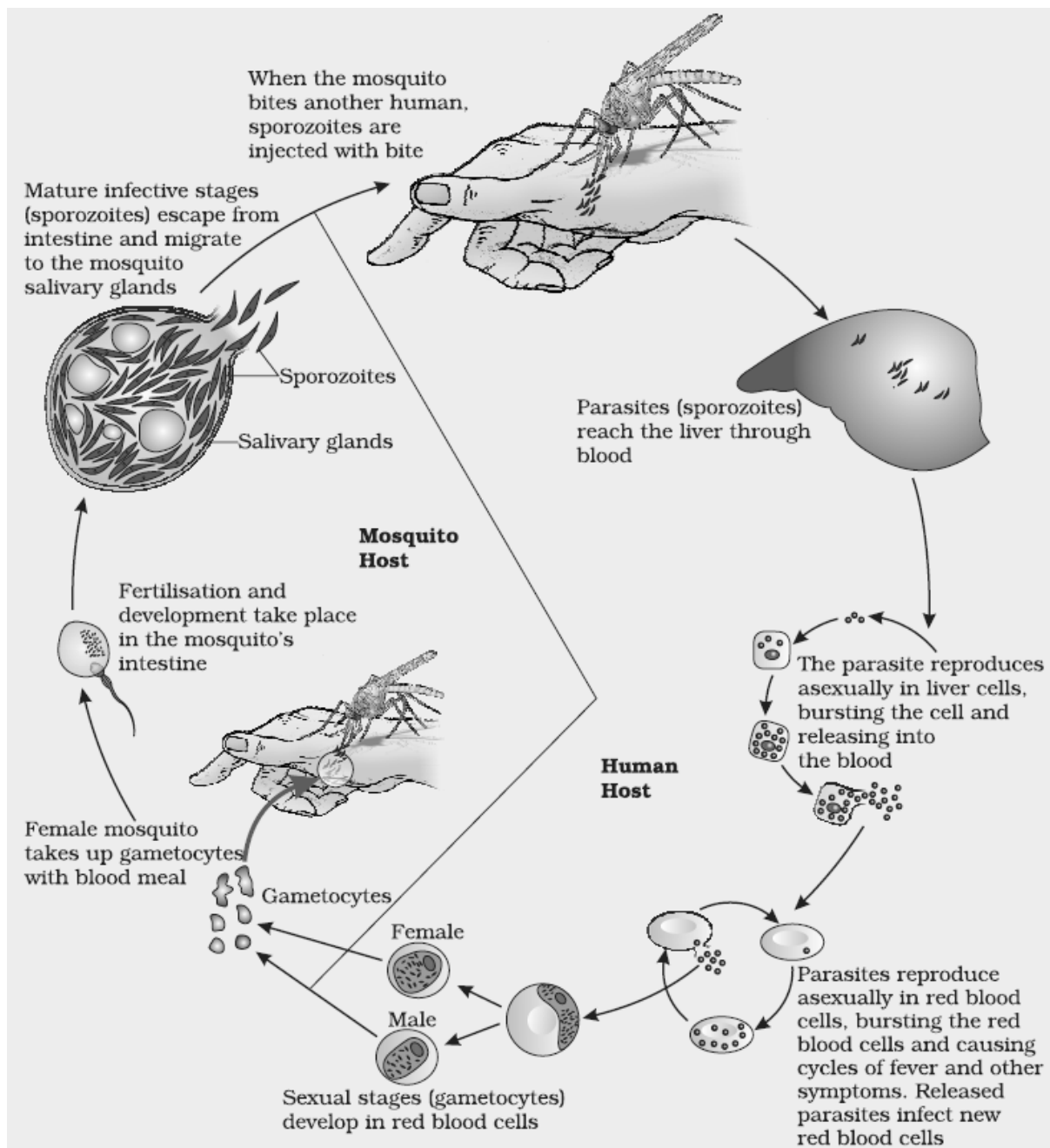
- Malaria is characterized by fever at intervals, sudden acute chills ( cold or rigor state) accompanied by shivering followed by rise in temperature. Peak fever is  $41.1^{\circ}\text{C}$  or  $106^{\circ}\text{F}$  which persists for 3-6 hours. After 2-4 hours of fever there is profuse sweating which lowers the body temperature to near normal.
- Malaria is also accompanied by nausea headache, laziness and muscular pain. It also results in anemia and splenomegaly.
- Clinical fever in malaria is due to erythrocytic schizogony

#### Treatment

- Drugs like chloroquine and primaquine are administered to treat malaria. Other drugs like quinine obtained from the bark of cinchona plant, Cimaquine, daraprim and artemisinin obtained from Artemisia annua.

#### Prophylaxis

- Fitting doors and windows with wire nets, using mosquito nets while sleeping, applying mosquito repellents at night, taking smaller prophylactic dose of anti-malarial drugs at weekly intervals during malarial season can prevent effectively from infection of malaria
- Spreading areas with DDT, BHC and other insecticides. Introducing *Utricularia*, ducks and larva eating fishes call *Gambusia*, stickle back and trout in larger water reservoirs for blocking the respiration of the larvae, covering all drains, introducing larvicidal *Bacillus sphaericus*, blue green algae like *Aulosira* and *Anabaena* in water bodies can help to protect against the breeding of mosquitoes
- National Malaria Eradication [Control] Programme was launched by the Ministry of Health of the Government of India with the assistance of World Health Organization ( WHO ) in 1962 and almost controlled it by destroying the mosquitoes with DDT and other insecticide



**AFRICAN SLEEPING SICKNESS OR TRYPANOSOMIASIS**

- African sleeping sickness is of two types:
  - (i) Gambian ( W. African ) sleeping sickness caused by *Trypanosoma gambiense* by the bite of the blood sucking tse-tse fly. *Glossina palpalis*.
  - (ii) Rhodesian ( E. African ) sleeping sickness caused by *Trypanosoma rhodesiense* by the bite of tse-tse fly.
- *Trypanosoma* is a protozoan which is digenetic having two hosts
  - (i) Primary host man
  - (ii) Antelope as reservoir host
  - (iii) Secondary host tse-tse fly *Glossina palpalis*

- The parasite lives in the blood stream and in the lymph, it invades the cerebrospinal fluid of the CNS causing fever, anemia, lethargy and death
- Chaga' disease ( American sleeping Sickness) is caused by Trypanosoma cruzi spread by the bite of blood sucking bug Triatoma Sp.

#### Mode of infection

- The infection is initiated by the bite of tse-tse fly which harbours the infective metacyclic forms in the lumen of its salivary glands
- Then the parasite undergoes multiplication extracellular on sucked up to tse-tse fly along with the blood meal
- In human beings, the parasite live in the blood plasma
- Later the parasite enters cerebrospinal fluid and damages the brain

#### Symptoms

- This disease is characterized by swelling of lymphatic glands, irregular recurrent fever followed by weakness, loss of weight, anemia, increase in pulse rate and severe headache
- In due course the patient fall asleep, first at regular intervals and then lies prostate in coma. Ultimately lead to death

#### Treatment

- Trypanosomiasis can be treated in early stages by the drugs suramin sodium, atoxyl, tryparsamide, germanin etc. But it is very hard to control it once the parasites have entered the cerebrospinal fluid. Orsamine is fairly effective treatment when the CNS is involved

#### Prophylaxis

- Prevention depends on the eradication of tse-tse fly by insecticides like DDT

#### KALA – AZAR OR DUMDUM FEVER OR VISCERAL LEISHMANIASIS

- Kala – azar known as Black fever or Dumdum fever is a serious oriental disease of man. This disease is caused by the protozoan Leishmania donovani through the bite of the sand fly Phlebotomus.
- Primary host –man  
Secondary host –sand fly  
Reservoir host – dog

- In man , *L. donovani* lives as an intercellular parasite in leucocytes or cells of liver, spleen bone marrow, lymphatic glands etc.
- Incubation period is long from 3 to 4 months and symptoms may appear even after 2 years

#### Symptoms

- Early symptoms of kala-azar include swelling, high fever and enlargement of spleen and liver, followed by general weakness, emaciation, anemia due to reduction in number of blood cells and a peculiar darkening of skin
- In advanced stage hair becomes brittle and falls out. The body immune system becomes so weak that secondary infection by bacteria or viruses lead to death

#### Treatment

- Pentavalent antimony compound like sodium antimony tartrate and glyconate urea stibamine, aminostiburea, neostibosan etc. are used for treatment of kala-azar

#### Prophylaxis

- Eradication of the insect vector sandfly by insecticides, eliminating the reservoir host and avoiding the bite of sandfly are prophylactic measures against kala-azar
- Other Leshmanial diseases of man
- oriental sores – *Leishmania tropica*
- Naso –pharyngeal leishmaniasis – *Leishmania*.
- South – America kala azar – *Leishmania chagasi*

#### CILIARY DYSENTERY ( BALANTIDIASIS)

- Ciliary dysentery is caused by ciliated protozoan named *Balantidium coli*. The protozoan inhabits the human large intestine and reproduces there asexually by transverse binary fission and sexually by conjugation. This is followed by cyst formation and cysts pass out in the hosts faeces
- Infection occurs by ingesting cysts in food and drinks

#### Symptoms

- The protozoan causes ulcers in the colon and invades hyaluronidase. This generally results in vomiting abdominal pain, weight loss diarrhoea

### Treatment

Tetracycline and iodoquinol are effective treatments against the disease

### Prophylaxis

- Protection of food articles from dust and flies that may carry cysts in the best prevention from infection

### GIARDIASIS

- Giardiasis, is a protozoan disease caused by *Giardia intestinalis*. It inhabits upper part of small intestine ( duodenum and jejunum )
- It is the first human parasitic protozoan known
- It does not infect the intestinal wall but increases its number in the lumen and interferes with food absorption. A large number of cysts are formed which are released with faeces
- Infection is by contamination of food and drink with cyst

### Symptoms

- Characterized by epigastric pain, abdominal discomfort, headache and mild diarrhea involving passage of pale, bulky, foul smelling and greasy stool

### Prophylaxis

- Clean water supply, infection free food, proper washing hands, fruits and vegetables before eating etc.

### FUNGAL DISEASES [ DERMATOPHYTOUS]

- They are ringworm or round red or silvery type of superficial fungal infections of skin caused by species of *Trichophyton*, *microsporeum* and *Epidermophyton*. There are dry scaly lesions on skin, nails and scalp that causes intense itching. Heat and moisture promotes growth of these fungi especially in skin folds. Common source of infection are soil and towels, cloths, combs etc of infected persons
- (i) *Trichophyton rubrum* : Dermatophytoses of foot ( like foot ringworm, athlete's foot, tinea pedis), onychomycosis ( fungal infection of nails), ringworm of groin ( tinea cruris, dhobi itch, jockey itch)
- (ii) *T. mentagrophytes*: *Oxeychomycosis*, ringworm of body ( tinea corporis, tinea circinata ), ringworm of beard ( tinea barbac or barber's itch.

- (iii) *T. tonsurans*, *T. violaceum*, *Microsporum andoninii* Ringworm of scalp ( *tinea capitis* )
- (iv) *Microsporum canis* : Cats and dogs and from there to children – *tinea capitis*, *tinea corporis*
- (v) *Epidermophyton floccosum*, *E. cruris*, *Tinea cruris*, *tinea pedis*, *tinea manum*, *tinea corporis*, *oxychomycosis*

## HELMINTHIC DISEASES

### ASCARIS

- Common ascariasis is caused by the common round worm *Ascaris lumbricoides*. It is a giant intestinal worm, white in colour and female longer than in male. Females lay about 200,000 eggs daily that pass out with human faeces and remain alive in soil for several days
- There is no intermediate host of the parasite so man acquired infection by directly ingesting *Ascaris* eggs, containing the infective stage rhabditoid larvae, with contaminated food or water

### Symptoms

- Since a large number of adult *Ascaris* worm normally infect a single host, they obstruct the intestinal passage and thereby cause abdominal discomfort like colic pains. The patient may also suffer from impaired digestion, diarrhea and vomiting.
- They sometimes bore the intestinal epithelium and lead to some vital organs like kidneys spinal cord, brain or muscles causing injuries to the organs.
- They cause pneumonia with fatal consequences, with inflammation of alveolar tissue followed by oedema. The infection is followed by anaemia, leucocytosis and eosinophilia. Worms produces toxins which cause irritation of mucous membranes, nervous system like convulsions, nervousness, etc.

### Treatment

- Infection of *Ascaris* can be treated with dose of hexylresorcinol crystals in a gelation capsule after about 12 hours of fasting. Some antihelminths drug like oil of chenopodium tetrachlorethylene, piperazine, hetrazan etc are also followed effecting against worms.

### Prophylaxis

- Soil pollution with faecal matters should be prevented.



- Vegetable and fruit should be thoroughly washed.
- Finger nails should be cut regularly as eggs can accumulate below them.
- Children are more prone so abstaining children from sanitary habits.

#### FILARIASIS OR ELECPHANTIASIS

- The disease is due to nematode *Wucheria bancrofti*. Another species is *Brugia malayi*. This disease spread by them are respectively called bancroftian filariasis and brugian filariasis
- The pathogen is spread from one human being to another through mosquitoes like *Culex* and to a less extent by *Amopheles* and *Aedes*
- The parasite resides in lymph vessels, connective tissues and mesentery
- The parasite is viviparous. The young ones are called microfilariae . They are hardly 2.5 cm long
- Microfilariae enter the blood vessels and reach the skin area during night for being picked by female mosquito for completion of life history and change into infective stages
- The infective parasites are deposited near the site of mosquito bite. They pass through the punctured skin and reach the lymphatic system

#### Symptoms

- i) In the first stage, the patient has increased eosinophils, enlarged lymph nodes and positive intradermal parasite test
- ii) Second or carrier stage is symptomless but right blood examination can reveal the parasite
- iii) Third stage is characterized by filarial fever, inflammation of lymph nodes and lymph vessel
- iv) The final stage is manifested by thickening of subcutaneous tissues and skin so that there is permanent swelling mostly feet, legs, thighs, scrotal sac, breast etc. it is called elephantiasis

#### Treatment

- The disease can be cured by drugs like ivermectin, DEC and diethyl carbamazine ( DEC )
- Reconstruction of affected body parts through surgery
- The disease can be prevented by taking precautions against mosquito bites

## CANCER

- Cancer is a group of diseases characterized by uncontrolled proliferation of cells and ability of proliferated cells to invade other tissues / parts body. It is more common in old persons after 40 days and in tissues where cells undergo divisions regularly
- Neoplasm is a new abnormal tissue that is capable of continued growth, formation of tumour, crowding and disrupting of normal cells. Tumours grow or swelling are caused by abnormal proliferation of cells
- They are of two types, benign and malignant. Benign tumour is a large localized mass of abnormal tissue which pressures other tissues and cause pain but does not infiltrate adjacent tissue because it is encapsulated in connective tissue, malignant tumour is a large mass of abnormal tissue which is not encapsulated, is capable of invading adjacent tissue and distant sites
- Metastasis is spread of cancerous cells from one part of the body to other parts through blood, lymph or formation of secondaries from a malignant tumour
- Cancers are of three types
  - (i) Carcinoma : It is cancer of epithelial / epidermal tissue and their derivatives like skin, mucous membrane, glands, lungs, breast, pancreas, stomach etc
  - (ii) Sarcoma : It is the cancer of primitive mesodermal tissue like connective tissue, bones, muscles, lymph nodes, etc. Depending upon the tissue involved, sarcoma is of several types e.g. lymphoma ( involving lymph vessels ), lipoma ( adipose tissue ) osteoma ( bone), malignant reticulosis etc
  - (iii) Leukemia : It is malignancy where there is unwanted and uncontrolled increase in number of white blood corpuscles ( 200,000 – 1000,000 mm<sup>3</sup>) and immature or myeloid stem cells. In common type of Leukemia, the white blood corpuscles infiltrate bone marrow, spleen, liver, lymph nodes and other organs causing damage and increasing their size. In myelocytic leukemia ( 9<sup>th</sup> and 22<sup>nd</sup> chromosomes bring their jumping genes together) erythroblastic tissue of bone marrow degenerates. There is bleeding at different places. Tonsils and cervical glands enlarge. The most common cancers in India are mouth throat cancer in man and uterine cervical cancer in women.
- Carcinogenic factors : Factors inducing cancer
  - (i) Carcinogens / chemical carcinogens

These are substances / environmental pollutants which causes cancer. Example soot, coal tar (skin and lungs), cigarette smoke ( N-nitrosodimethylene – lungs), Cadmium oxide ( Prostate gland), aflatoxin ( liver) 2-naphthylamine and 4-aminobiphenyl ( urinary bladder), mustard gas ( lungs) nickel and chromium compounds ( lungs), asbestos ( lungs, pleural membrane), diethylstilbestrol ( vagina), vinyl chloride ( liver), artificial sweeteners, excessive coffins, diet rich in animal proteins ( digestive tract ), sex hormones ( breast cancer).

(ii) Radiations

Both UV and ionizing radiations increase the incidence of cancer. Leukemia incidents are 10 time more in radiologists. Skin cancers are more common in areas with high UV radiations.

(iii) Heat

Reverse smoking causes mouth cancer. Kangri ( heating devices) increases incidence of cancer in Kashmir.

(iv) Tobacco

Tobacco chewing produces mouth cancer. Smoking increases chances of throat and lung cancer.

(v) Mechanical agents

Friction, trauma or continuous irritation seems to produce cancer.

- Cocarcinogens

They are chemicals or factors which function as cancer / tumour promoters. Cocarcinogens or epigenetic carcinogens promote neoplastic growth only after inhibition by carcinogen some cocarcinogens are Polonium, Nickel, Nicotine, Saccharine, Menobarbitol

- Mechanism / Carcinogenesis

It occurs through following stages

- (i) Initiation: Carcinogens produce DNA lesions Epidemiological studies indicate that initiation of cancer occurs in childhood and youth
- (ii) Promotion : Proto –oncogenes are changed to oncogenes. A cell with oncogene is called latent tumour cell. Promotion is reversible common promoters are saccharine and phenobarbitol
- (iii) Loss of adhesion or loss of contact inhibition : Normal cells do not divide because of contact inhibition. Latent tumour call losers contact with other cells. This changes it into active tumour cell
- (iv) Progression : The active tumour cell begin to divide and forms neoplasm or cell aggregate which later turns into tumour. Progression is slow so that

external symptoms do not appear till the tumour is formed. It presses adjacent organs and tissue.

- (v) Metastasia : Tumour cells are also called cancer cells. They become less adhesive. The cancer cell do not undergo differentiation. They release angiogenic factors which stimulate growth of blood vessels. Soon the cancer cells begin to migrate with or without secondaries
- Cancer cells have irregular, hypertrophied nucleus, abundant nuclear granules, increased number of lysosomes, reduced cristal in mitochondria, more melanin mucus fat droplets and debris in cells. Further, genes llike ERCA1, BRCA2, CDH1, MLH1, PTEN mutate. This reduces the ability of DNA to repair itself. Same of the mutated genes were previously working as tumour suppressor genes

#### Symptoms

- A lump or hard area, swelling or sore that does not heal, unexpected loss of weight or hoarseness, change in colour of mole / wart, a change in digestive / bowel habits, loss of blood through a natural orifice or excessive loss of blood in women.

#### Diagnosis

- Biopsy of tissues endoscopy ( gastroscope for stomach, laproscope for pelvic region), X-rays ultra –sound.

#### Anticarcinogens

- They are substances which prevent the action of carcinogens, Anticarcinogens occurs in green yellow vegetables, fruits and milk. They are riboflavin ( milk), flavonoids ( green yellow vegetables and fruits), vitamin C, indoles ( cabbage, cauliflower), retinoids ( milk, carrot, butter), some synthetic oxidants in preserved foods ( butylated hydroxyl anisol and toluene ) etc.  $\beta$ - carotene present in green – yellow vegetables is promoter – inhibitor which weakens the action of cancer promoters

#### Treatment

- Surgery, bone marrow grafting ( Leukemia), radiotherapy ( exposure to radioactive isotopes), hormonal therapy, chemotherapy. Two drugs ( vincristin and vinblastin) from cantharantus roseus are effective in controlling leukemia. Taxol is anti –cancer drug obtained from Texus baccata.

- Prophylactic intake of taxomifen and raloxifene keeps breast cancer under check . Recently a drug tetrathiomolybdate has been tried with some cancer. It arrests tumour growth by starving cancer cells of copper PARP ( Poly ADP ribose poly merase) inhibitors also kill tumour cells with no side effects. Extract from Fagonia cretica has been found to cure breast cancer.