HEALTH

It is often said, “Health is Wealth”. Healthy person is one who is in state of complete Physical, Mental and Social well-being. Health is viewed as Holistic concept and categorized into following four dimensions or types.

PHYSICAL HEALTH
MENTAL HEALTH
SOCIAL HEALTH
SPIRITUAL HEALTH

Physical Health: It means Normal and Optimal functioning of all organs of body.

Mental Health: It refers to balance of individual to its surroundings

Social Health: It means that person is free from inter-personality issues and interacts well with society.

Spiritual Health: It means that person has certain values and beliefs which provide him with purpose in life. He also has commitment to the higher being (All mighty GOD)

A healthy individual enjoys good quality of life, contributes to the economic growth and helps in reducing the expenditure on the medical care.

MICROBIOLOGY

It is that branch of Life Science, which involves the study of Unicellular, Multi-cellular and Cell-cluster organisms; which can not be seen with naked eye but can only be seen after magnification (with help of Microscope). The organisms studied in this subject are called Micro-organisms or simply Microbes. Louis Pasteur 1822-1895 (27/12/1822 to 29/09/1895) is considered to be the ‘Father of Microbiology’.

Classification of Microbes

Depending upon cellular organization, microbes are classified in following three categories

PROKARYOTES
EUKAYOTES
VIRUSES

Prokaryotes: These are those microbes in which nucleus and cell organelles are not bound by membrane e.g. Bacteria and Archaea

Eukaryotes: These are those microbes in which nucleus and cell organelles are bound by membrane e.g. Algae, Fungi, Bacteria.

Viruses: These are non-cellular in character and are not capable of independent living and reproduction. These are tiny bundles of Genetic material (DNA or RNA) present in a shell called envelope.

BACTERIA (BACTERIUM)

These are Uni-cellular or Multi-cellular Prokaryotes. Depending upon shape these are divided into Bacillus (Rod), Cocci (Spherical), Spirilla (Spiral) and Vibrio (Curved or comma shaped). Depending upon oxygen requirement these are- Aerobics, Anaerobics and Facultative anaerobics. Depending upon mode of nutrition, these are- Autotrophs, Heterotrophs (Saprophytes and Parasites) and Chemotrophs.

Bacteria have cell wall of Peptidoglycan and move by presence of Flagella. Bacteria are responsible for most of infectious disease.

ALGAE (Alga)

These are Eukaryotic organisms, green in color, Uni or Multi-cellular body, requiring water or damp place to grow. These are Autotrophs and produce Carbohydrates and Oxygen.

FUNGI (Fungus)

These are mostly Multi-cellular, the cell wall being of Chitin. The body is made up of tube like filaments called Hyphae. All hyphae collectively are known as Mycelium. The fungi can be Saprophytes, Parasites or even Symbiotic. These multiply through tiny spherical structures called Spores.

PROTOZOA (PROTOZOAN)

These are Uni-cellular, aerobic organisms having cell wall made up of Cellulose. These can be Flagellated, Ciliated or amoeboid; hence show movement by these structures. These are mainly Heterotrophs.

CULTURE OF MICROBES

For identification and research studies, micro-organisms are required as pure culture (Population of single type of microbes). This calls for culture (Growing in Lab.) of microbes.

For culturing bacteria, suitable CULTURE MEDIUM is prepared and sterilized (Heated in presence of steam at 121^0 C for 15 minutes to kill all bacteria). This medium is suitably cooled and INOCULATED (Mixed) with desired volume of INOCULUM (Material having bacteria to be grown). The inoculation process is done under ASEPTIC CONDITIONS (Microbes free environment) and then this inoculated culture medium is INCUBATED (placed at required temperature for the microbes to grow).

For culturing bacteria mainly NUTRIENT BROTH and NUTRIENT AGAR are used. These are general purpose medium to grow bacteria. The formula for Nutrient broth is-

Beef Extract	01 g
Yeast Extract	02 g
Peptone	05 g
NaCl	05 g
Purified Water	up to 1000ml

The Beef extract and Yeast extract Contain Carbohydrates, Vitamins, Organic Nitrogen and salts. Peptone is enzymatic digest of animal proteins and serves as source of Nitrogen (Amino acids). The NaCl help in maintaining the salt conc. to be same as that of Microbial cytoplasm.

Nutrient broth is liquid culture medium. If solid medium is desired then Nutrient broth is solidified using 1.5 % agar. (15 g/1000ml).. This medium is called Nutrient Agar.

PURE CULTURE

During study of m. o. we may require just one type of bacteria. These can be obtained from pure culture. Pure cultures are those cultures of m. o. which have population of only single type of m. o. This type of culture can be obtained by following methods-

- Streak Plate Method
- Serial Dilution Method
- Single cell isolation method
    i. Capillary pipette method
    ii. Micromanipulator method

STREAK PLATE METHOD- Using sterile loop, inoculum is applied to agar plate as a line. Now by use of sterile loop, the inoculum is streaked as a line at right angle to the original line. From this streaked line further streaking is done at right angle. This way of streaking helps micro-organisms to spread as individual m. o. and upon incubation, each develops into a colony of single type of bacteria. If growth is seen as separated colonies, then the method is considered as successful.

SERIAL DILUTION METHOD- The inoculum is taken in a sterile test tube and diluted up to 10 times using sterile water. The dilution is repeated many times till a fairly good dilution (quite less number of bacteria per ml) is achieved. Now suitable volume of inoculum is selected and mixed uniformly in warm sterile agar medium. It is now incubated to get separate colonies each having single type of population.

SINGLE CELL ISOLATION METHOD- In this technique, single microbial cell is separated from the culture of bacteria and incubated in suitable culture medium to produce pure culture. This is comparatively difficult and expensive technique. Isolation of single cell can be done in following two ways

Capillary pipette method- Serial dilutions are prepared from the inoculum and drops of final dilution are placed on sterile cover slips. These drops are viewed under microscope and the drop having only single bacteria is selected. This single bacterium is transferred to culture medium, using capillary pipette and incubated to get pure culture.

Micro-manipulator method- the microbial culture is taken and under microscope, with help of fine needle, a single cell is made to move away from rest of cells. The cell is separated and incubated in culture medium to get pure culture.

STAINING

It means to dye (Colour mark) a microbe with penetrating dyestuff or pigment for microscopic examination.

IMPORTANCE

- Staining provides contrast hence highlighting the different structures of microbial cell
- Helps in identifying microbes
- Helps in differentiating microbes

TYPES OF STAINING TECHNIQUES

1. SIMPLE STAINING
    i. Monochrome Staining
    ii. Negative Staining
2. DIFFERENTIAL STAINING
3. SPECIAL STAINING

Simple staining

In this Technique we use only one dye for staining purpose. This technique finds use in study of morphology and arrangement of bacterial cells. This staining is divided into Monochrome and Negative Staining

Monochrome Staining- In this staining we mainly use dye like Methylene blue, Crystal violet and Carbol Fuchsin. These are basic dyes and bind strongly with Nucleus and cell organelles of bacteria. (Basic dyes have positively charged chromophore, which is attracted by negatively charged m. o,)

The air-dried and heat fixed smear of bacteria is flooded with alcoholic or aqueous solution of dye. After 30 - 60 seconds the excess dye is washed off, using alcohol or water. Smear is dried and viewed under microscope after applying immersion oil.

Negative staining- In Negative staining we use acidic dye (Negatively charged chromophore) like, Eosin, Rose Bengal stain, Nigrosin and Congo red.

To stain, the m. o. are mixed with dye and spread as thin film. Film is then dried and viewed after putting immersion oil on it.

Acidic dyes have negatively charged chromophore, which is repelled by negatively charged m. o. Hence m. o. are seen as transparent or white cells against the dark back ground.

Differential Staining

In differential staining, more than one dye is used. This leads to better differentiation of bacterial cells. This technique is also used for DLC (Differential Leucocytes Count),

for detection of different types of WBC. Grams stain is extensively used differential staining.

Gram's staining-In this technique; bacteria are stained using crystal violet, followed by Iodine treatment. The crystal violet and iodine form complex in the cytoplasm and stain the bacteria Blue or Violet. Now washing is given with Alcohol or Acetone. The Gram positive bacteria (Cell wall made up of Peptido-glycan) retain stain while Gram negative bacteria (Cell wall made up of lipo-polysacchride) lose this complex. These bacteria (Gram negative) are now stained using Safranin or Fuchsin (Basic dyes). Gram negative bacteria take up the pink colour.

Acid Fast Staining- It is another example of differential staining. In certain bacterial cell walls, a waxy material (Mycolic acid i.e. β-hydroxy acids up to 90 carbon atom chain) is found which does not allow the easy entry of dyes.

These are stained with Carbol Fuchsin and heated for long time. Heat and prolong exposure to the dye, makes the bacteria to take up the dye and the bacteria appear red. Now washing is done using acidified alcohol (3% HCl in alcohol (95 %)). Certain bacteria retain dye (stain). These are called Acid Fast bacteria. Others lose stain. These are called Non Acid Fast bacteria. The non-acid fast bacteria are counter stained using Methylene Blue and these appear blue e.g. Mycobaterium bacteria.

Special Staining

This staining technique is used to stain specific parts of bacteria like

Staining of Volutin or Metachromatic granules in Corynebacterium diphtheria, which appear beaded upon staining with Albert's stain

Staining of Capsules using Gram's and Leishman stain, where capsules appear clear halo.

Staining of spores using malachite stain, washing it with water (washing removes stain from vegetative cells but not from spores) and then using Safranin to stain the vegetative cells. Spores appear dark green while vegetative cells appear pink

Similarly special staining is adopted to view flagella and certain constituents like Antigen. Special staining is also adopted to stain bacteria present within the tissue samples.

DISEASES CAUSED BY MICRO-ORGANISMS

Bacterial diseases

Cholera (*Vibrio cholerae*)
Diphtheria (*Corynebacterium diphtheriae*)
Leprosy (*Mycobacterium leprae*)
Peptic ulcer (*Helicobacter pylori*)
Pneumonia (*Streptococcus pneumoniae*)
T. B. (*Mycobacterium tubercle*)
Tetanus (*Clostridium tetani*)
Typhoid (*Salmonella typhi*)

Viral diseases

AIDS, Chikungunya, Common cold, Dengue, Hepatitis, Measles, Polio and Small-pox.

Protozoan diseases

Amoebiasis, Dysentery, Malaria, Sleeping sickness

Fungal diseases

Ringworm

COMMUNICABLE DISEASES

A communicable disease is one which spreads from one person to another. It is also known as 'INFECTIOUS DISEASE'. These diseases spread mainly through personal contact, or contaminated water, air and food. These may also spread via other species; in which case these species are referred as 'VECTORS'. These diseases may even become 'EPIDEMICS' depending upon environmental conditions, Social settings and Hygiene maintained. Hence it is important to know the Causative agent of disease, mode of its spread and steps necessary to curb its spread.

CLASSIFICATION

Communicable diseases are classified based upon-

CAUSATIVE ORGANISM

MODE OF TRANSMISSION

Based on Causative Organism-

Helminthes diseases- Ascariasis, Taeniasis, Liver rot (Liver fluke), Filariasis and Trichinosis

Rickettsial diseases- Thyphus fever, French fever, Q. fever, Rocky Mountain spotted fever.

Based on Mode of Transmission

Contagious diseases- These are those communicable diseases which spread by coming in contact with an infected person like Chicken pox, Small pox, Measles, Leprosy and STD

Non Contagious diseases- These are those communicable diseases which spread through contaminated food, water and air but not by physical contact like Cholera, Ascariasis, Thyphoid and diseases caused by biting of vector like Malaria, Dengue, Plague and Filaria.

MODE OF TRANSMISSION OF COMMUNICABLE DISEASES-Communicable diseases spread by transfer of causative organism to the body of healthy individual by following possible means. This transfer is possible in following ways-

Droplet Contact- Coughing and sneezing releases Microbes which can infect healthy individuals.

Direct Physical Contact- e.g. Hand shake (Common Cold)

Indirect Contact- Touching a contaminated surface or objects (wash room handles)

Air Borne Transmission- Microbial and fungal spores can persist in air for quite a long time.

Fecal Oral Transmission- Contamination of food and water with fecal matter. (Helminthes diseases and Cholera, Amoebiasis and Typhoid)

Vector Borne Transmission- The carrier insects (Vector) bite healthy individuals to spread diseases like Malaria, Dengue, Sleeping sickness.

MEASURES OF PREVENTION OF COMMUNICABLE DISEASES-

Diagnosis- Disease is diagnosed based upon clinical symptoms and Laboratory tests.

Notification (Reporting)- Each case of Communicable disease is reported to designated authority for taking appropriate steps.

Isolation- Patient is kept in isolation, in hospital or at home so as to prevent further spread.

Treatment- Patient is given the full course of treatment (Usually Antibiotics) or till full recovery occurs. Sometimes total family or society may require the treatment. (Therapeutic or Prophylactic)

Quarantine- Patient suspected to have got infected is quarantined for the incubation period of disease so as to prevent spread.

Investigation- The affected area is investigated by the health authorities to judge the scale of problem and appropriate steps taken.

Disinfection- Excreta, skin, hair, cloth, bed sheets, bandages and body fluid are appropriately disinfected, so as to prevent spread.

Blocking Transmission- this means taking measures so as to block the transmission of infection. This can be achieved in following ways-

- By boiling drinking water.
- By wearing mask (To avoid air borne infections)
- Use of suitable insecticide, mosquito repellant, mosquito nets, rat and bat traps
- Immunization- By using Vaccines

Education- General Public is educated to make them aware about spread of infection, importance of clean and healthy environment, preventive measures and immunization schedule.

RESPIRATORY TRACT INFECTIONS (RTIs)

Respiratory tract infections means- infections of Nose, Sinuses, Throat, Air-ways (Trachea and Bronchi) and lungs. The infections affecting Nose, Sinuses and Throat are referred as Upper Respiratory Tract Infections (URTI or URI); while infections of Airways and Lungs are called Lower Respiratory tract infections (LRTI or LRI)

(URTI or URI) – Various infections of Upper Respiratory tract are-

Common Cold, Influenza, Whooping cough, Tonsillitis, Sinusitis and Laryngitis. Children get the URTI easily as their immunity is not very strong.

(LRTI or LRI)- These are-

Tuberculosis, Influenza, Pneumonia and Bronchitis

CHICKEN POX

Causative Agent- Chicken Pox is common ailment of childhood. It is caused by **Varicella-Zoster virus**.

Incubation Period – 2 – 3 weeks

Symptoms- After incubation period, the patient feels stuffy or running nose with slight cough, feverish, headache, tiredness, loss of appetite, nausea and vomiting.

Within 24 to 48 hours of these symptoms, red papules appear on chest and back. These are quite itchy and soon turn to small fluid filled blisters; which soon dry up forming brown crust upon them.

Mode of Transmission – Chicken pox spreads by coming in contact with blisters, saliva or mucus of infected person. Coughing and sneezing produces droplets which also spread infection.

Treatment and Prevention – No known treatment is available, treatment is given to mainly control symptoms. Varicella-zoster Immunoglobulin (VZIg) vaccine, if given within 72 hours of exposure; can prevent or modify infection.

Children are given two doses (12 – 15 months and 4 – 6 yrs. of age)

MEASLES

It is highly contagious disease occurring mainly in infants and children. It is also known as Rubeola or Mobilli

Causative Agent- RNA paramyx virus (Rubeola virus)

Incubation Period – 10 days for onset of fever. 14days for onset of rash

Symptoms- High fever, Sneezing, running nose, redness in eyes (conjunctivitis) and photophobia. Reddish brown rash start appearing behind ear and spread to whole body through face and neck.

Mode of Transmission - It is very contagious disease. It spreads through means of saliva by droplet and droplet nuclei. Vitamin A deficiency is a risk factor for measles.

Treatment and Prevention - No known treatment is available. Mainly anti-pyretic is given. Vitamin A dose is also helpful.

For immunization dose (0.5ml subcutaneously) is given at the age of 9 – 12 months.

INFLUENZA

Influenza is highly communicable disease. It is also known as FLU and is caused by a RNA virus. It can affect humans, birds and mammals.

Causative agent- It is caused by a **RNA virus called Influenza virus.** This virus is of three types-

Type A- This virus can attack humans, birds and other mammals.

Type B- This virus attacks only humans.

Type C- This virus attacks only humans.

Incubation period- 01 to 04 days

Symptoms- Patient feels Headache, Body ache, Fever, Anorexia, Lethargy, Soreness of throat and Cough.

Mode of Transmission- The virus spreads through air via droplet and droplet nuclei due to coughing and sneezing. The virus enters the healthy individual through respiratory tract.

Treatment and Prevention- Influenza can be prevented by using single dose (0.5 ml S/C) of killed, live attenuated or split virus vaccine, at the age of 03 yrs.

Antiviral drugs (Amantadine and Rimantadine) are also useful. (100mg twice daily for 02-05 days)

DIPHTHERIA

Diphtheria is URTI affecting Nose, Throat, Tonsils and Pharynx.

Causative agent- It is caused by bacteria *Corynebacterium diphtheria*.

Incubation period- 02 to 05 days

Symptoms- Diphtheria is characterized by following symptoms-

- Difficulty in swallowing and breathing
- Fever
- Fatigue
- Enlarged lymph nodes
- Grey or yellow coloured patches in Throat
- Slurred Speech
- Changes in vision
- Sign of Shock (Pale & cold skin, Sweating and excessive breathing.

Mode of Transmission- This bacterium enters body through respiratory tract, via close physical contact, droplets and materials of common use like cloth, utensils and furniture

Treatment and Prevention- Diphtheria can be treated by use of Antibiotics. For prevention DPT vaccine is used.

0.5 ml I/M at 06, 10 & 14 months

First booster at 18 months

Second booster at 3 – 5 yrs

WHOOPING COUGH

Whooping cough is also known as PERTUSIS. It is acute bacterial infection of airways (LRTI). The bacterium attaches itself to the lining of airways leading to swelling. This becomes the cause for violent and uncontrollable coughing.

Causative agent- Pertusis is caused by bacterium *Bordetella pertusis*

Incubation period- 07 to 10 days

Symptoms- Disease of Whooping cough progresses through following three stages-

Catarrhal stage- This stage is characterized by mild fever and running nose. It lasts for about 10 days.

Paroxysmal stage- This stage is characterized by spasm in breathing, attacks of irritating cough; without breathing and final inspiratory whoop. It lasts for 2 – 4 weeks.

Convalescent stage- This is recovery stage and may last for 1 – 2 weeks.

Mode of Transmission- An infected person contaminates air and fomities, with mucus from lungs and nose, during coughing and sneezing.

Treatment and Prevention- Whooping cough can be treated by use of Antibiotics. Best antibiotic is Erythrmycin. Ampillicin and Co-trimoxazole are also useful.

Prevention is by active immunization using DPT vaccine.

TUBERCULOSIS (T B)

Tuberculosis affects lungs and causes inflammation and necrosis of lung tissues. It is of two kinds

Latent T B- in this kind of T B the causative bacteria are present in the body in inactive state. Their presence causes no symptoms and person is not contagious, but there is always the chance of bacteria becoming active. (as per report, about 1/3rd population of world has latent T B with 10% having chance of becoming active.)

Active T B- In this kind the bacteria are present in actively growing stage and the person can spread infection.

Causative agent- T B is caused by bacteria *Mycobacterium tuberculosis.*

Incubation period- 02 to 12 weeks

Symptoms- Long episodes of coughing

Fever in evening

Blood in sputum

Weight loss, fatigue and Anorexia

Mode of Transmission- T B spreads through droplets spreading during coughing, sneezing, laughing and talking. T b does not spread through fomites.

Treatment and Prevention- T B is curable. Its early detection is always helpful. Its presence can be detected by X-ray examination of thoracic region, microscopic examination of sputum and by Mantoux test.

For treatment DOT (Directly Observed Treatment) is preferred. INH (Isoniazid), Ethambutol, Rifampicin and Streptomycin are used for treatment.

Prevention is by active immunization by BCG Vaccine.

INTESTINAL INFECTIONS

Intestinal infections means, infections of Stomach, Small intestine and large intestine. This infection usually leads to Gastro-enteritis. The most common symptoms are- Diarrhoea, Pain and cramps in abdomen, Nausea, Vomiting and flatulence. Intestinal infections occur due to consumption of contaminated or stale food. This infection may occur due to Viruses (Polio, Hepatitis) bacteria (Cholera, Typhoid) or worms (Hookworms). Food poisoning is mainly due to bacteria and their toxins.

POLIO (POLIOMYELITIS)

This infection affects CNS and causes temporary of permanent paralysis of limbs. This mainly affects children below 05 years of age.

Causative agent - Polio-myelitis virus.

This virus has three types- Types I, II and III. Type I is responsible for Epidemics.

Incubation period – 07 to 10 days. Sometimes it may be up to 30 days.

Symptoms – Fever, Sore throat, Headache, Vomiting, Pain and stiffness of neck and back, Pain and stiffness of legs and arms and flaccid paralysis of limbs.

Mode of Transmission – Infected person is potential source of spreading infection. Infection spreads due to contamination of food and water with infected fecal matter. The fingers can cause direct infection while flies and water are considered as indirect source of infection.

Treatment and Prevention – The infection can be prevented from spreading by following means-

Infected person be isolated

Stool and urine be properly disposed off.

Drinking water supply be protected from contamination

Flies be restricted from sitting of food

Vaccines be used for immunization

The killed virus vaccine (called IPV or Salk's vaccine) is available for injecting. Injections start at the age of o2 months and continue up to age of 4 – 6 years

The attenuated of weakened polio vaccine (called OPV or Sabine vaccine) is available for oral use. This OPV vaccine is being used to eradicate polio from the world.

HEPATITIS

Hepatitis means- inflammation of liver. Mainly viral infection is responsible for hepatitis but it may be due to consumption of Alcohol, drug induced, metabolic disorders or obstruction in bile duct. Patient may suffer from auto-immune or ischaemic hepatitis. Hepatitis may be self limiting or may advance to cause liver scaring. If hepatitis persists up to 06 months then it is called ACUTE hepatitis. Hepatitis beyond this period is termed as CHRONIC hepatitis.

Causative agent – Virus A, B, C, D and E types. Virus A and E usually lead to acute hepatitis. B, C and D type of virus cause chronic hepatitis.

Other causes of hepatitis are- Alcohol, drugs (Paracetamol and Antibiotics), Metabolic disorders (accumulation of Iron and Copper), Obstruction in bile duct (Gall stones or cancer), auto-immune response to the specific proteins present on the surface of liver cells and decreased blood supply to the liver cells (low BP) and obesity.

Symptoms – Sometimes the patient may remain asymptomatic, while in other cases severe liver dysfunction may occur; but blood test always confirms the presence of infection in liver cells. Usual symptoms of hepatitis are-

Jaundice, characterized by pale or yellow skin, eyes and urine

Loss of Appetite and Fatigue

Nausea, Vomiting and abdominal cramps

Low grade fever and weight loss

Mode of Transmission – Type A and E type virus infect via contaminated food and water (Fecal-oral-route). Type B, C, and D type infect via parenteral route (Blood, invasive procedures, mother to baby and through sexual contact)

Prevention – Various preventive measures against hepatitis are-

Early diagnosis by blood tests

Proper care during invasive procedures

Hygiene to protect contamination of food and water

Boiling of drinking water

Immunization using hepatitis A vaccine

CHOLERA

Cholera is the severe bacterial infection of intestine and may prove fatal if not managed properly

Causative agent – Bacterium *Vibrio cholera* (Gram Negative bacterium)

Incubation period – 12 hrs to 05 days

Symptoms – Watery diarrhoea with fishy odour

Vomitting, abdominal cramps and excessive thirst (dehydration due to these symptoms may prove fatal)

Mode of Transmission – Contamination of food and water with fecal matter of patient can spread the infection quickly. Water can act as reservoir of bacteria

Treatment and Prevention – Primary treatment of cholera includes use of antibacterial or antibiotic drugs and rehydration using ORS(Oral Rehydration Salt). The preventive steps are-

Proper sterilization (Chlorine bleach) of fecal matter and usable items of patient

Proper sewage disposal

Purification of drinking water (Chlorine, UV or Ozone treatment)

Use of cholera vaccine

Proper surveillance is must to predict and check the outbreak of cholera epidemic.

TYPHOID (Typhoid fever)

Causative agent – Salmonella typhi (a Gram negative short bacillus)

Incubation period – 01 to 02 weeks

Symptoms –

Prolonged fever

Headache, body pain and lethargy

Nausea, Diarrhoea or constipation and loss of appetite

Mode of Transmission – Through contaminated food and water

Treatment and Prevention – Typhoid can be treated using anti-biotics

For prevention killed bacterial vaccine is available (inject able, above 02 years)

Attenuated vaccine is used by oral route. Given after 05 years of age.

Proper sanitation is must to check the spread of typhoid. The street and improperly cooked food should be avoided.

FOOD POISONING

Food poisoning is acute type of Gastro-enteritis, caused by consumption of food and drinks contaminated with microbes, their toxins. Food poisoning may also be caused by ingestion of certain chemicals.

TYPES

Food poisoning is considered to be of three types

- Food poisoning caused by bacteria and their toxins
- Food poisoning caused by certain plants and animals
- Food poisoning caused by chemicals

FOOD POISONING CAUSED BY BACTERIA AND THEIR TOXINS

Bacteria and their toxins are most common cause of food poisoning. The various bacteria commonly poisoning food are-

Salmonella (*S. typhi*): This bacterium mainly infects milk, milk products, eggs, fish and meat.

Staphylococcus (*S. aureus*): This bacterium infects mainly milk, milk products, ice-creams and cream filled cakes.

Bacillus (*B. cereus*): This bacterium infects mainly starchy food (Potato, Pasta)

Escherichia (*E. coli*): This bacterium is present in raw or undercooked food and in unpasteurized milk.

Clostridium (*C. botulinum*): This bacterium is present in mainly preserved fruits and vegetables and pickles.

FOOD POISONING CAUSED BY CERTAIN PLANTS AND ANIMALS

This type of poisoning is caused by ingestion of certain mushroom and fish

FOOD POISONING CAUSED BY CHEMICALS

This type of poisoning is caused by ingestion of poisonous chemicals like Arsenic, Cadmium, Fluoride, fertilizers and insecticides/pesticides.

MODE OF TRANSMISSION

The poisoning of food spreads if food gets contaminated with soil or fecal matter. Raw and improperly cooked food is particularly more dangerous. Re heating food also increases the chance of poisoning. Cross contamination by handling raw and cooked food also helps in its spread. Unhygienic conditions in cooking area also help in its spread.

SYMPTOMS

- Nausea, Vomitting, Abdominal cramps and Diarrhoea with bloody stool
- Bloody urine
- Person may feel fever, chills or even dehydration

In case nervous system gets affected then the symptoms are-

- Blurred vision, speech problem, breathlessness and inability to move arms and legs

TREATMENT

No specific treatment is available. The symptom based treatment is helpful.

PREVENTION

- Only properly and freshly cooked food should be consumed.
- Protect food from flies, mice, rat, rodents, insects and dust
- Extra food should always be stored in refrigerator
- Persons engaged in food cooking and food handling should maintain personal hygiene
- Food animals should be free from diseases
- Strict hygiene be maintained in the cooking area

HOOK WORM INFECTION

Hook worm is a parasite. It lives inside the body of other living being. In humans it affects Skin, Lungs and Intestine

CAUSATIVE AGENT

The hook worms affecting man are *Ancylostoma duodenale* and *Necator americanus*

MODE OF TRANSMISSION

The female hook worm present in the intestine releases several eggs. When fecal matter gets mixed with soil, the eggs develop to larvae within soil. Upon coming in contact with human skin (Walking barefoot) these enter the skin by an enzymatic action and reach blood stream. These reach lungs and finally the intestine via mouth during coughing and swallowing.

In small intestine these get hooked to its wall and suck blood. These can stay in intestine for a year or longer and do the mating. Female worm discharges eggs which upon getting mixed with soil, develop into larvae and start the cycle afresh.

SYMPTOMS

- Skin rash: Red, raised and itchy area where the larvae enter.

- Fever, coughing and wheezing when in lungs
- Loss of appetite, abdominal pain, diarrhoea and weight loss
- Blood loss, anaemia, extreme weakness and fatigue.

TREATMENT

Albendazole and Mebendazole is given for 1 to 3 days. Iron supplement is also given to treat anaemia.

PREVENTION

- Do not defecate in open (Open Defecation Free ODF India)
- Do not walk bare-footed and do not sit on soil.
- Never consume soil contaminated food.
- Protect using gloves and shoes while gardening
- Pets be vaccinated against hook worm infection.

Arthropod borne diseases

MALARIA

Malaria is serious and sometimes fatal disease caused by species of PROTOZOAL parasite Plasmodium. Malaria is spread in humans by the bite of FEMALE ANOPHELES mosquito.

Causative agent: Malaria is caused by species of Plasmodium. These are-

Plasmodium falciparum; Causes severe malaria which may be fatal

Plasmodium vivax; Most common species, may lead to lapses

Plasmodium ovale; This species is found world wide

Plasmodium malariae; This species causes chronic type of infection

Incubation Period: 07 to 30 days but it depends on infecting species

Symptoms: Fever, Chills and sweating

Headache and body ache

Nausea and Vomitting

General weakness and Anaemia

Infection with P. falciparum may lead to Haemolytic anaemia, Kidney failure, Pulmonary oedema, Cerebral malaria, Convulsions, Coma and Death.

Mode of Transmission: Malaria is spread in humans by the bite of female Anopheles mosquito. The malaria can get transmitted from mother to unborn child, due to blood transfusion using infected blood and by sharing of needle for injection (As by addicts)

Treatment and prevention

Malaria is treated by use of Quinine, Chloroquine, Primaquine and Mefloquine along with antibiotic like Doxycycline

Presently Artemisinin from Artemisia annua is being used.

Preventive measures are-

- Use of mosquito nets on the beds
- Proper clothing so as to leave minimum exposed
- Use of mosquito repellant on exposed skin.
- Periodic use of insecticides to kill mosquitoes.
- Water should not be allowed to collect near residences. Cover it with layer of Kerosene
- Early diagnosis and treatment also helps in controlling its spread.

LIFE CYCLE OF MALARIA PARASITE

Plasmodium vivax completes life cycle in two hosts:

1. **Primary host:** Female Anopheles mosquito is the primary host. Plasmodium completes sexual phase (Sporogony) of its life in mosquito.

2. **Secondary host:** human is the secondary host. In human the plasmodium completes asexual phase (Schizogony) of its life.

When an infected female Anopheles mosquito bites a healthy person, it injects thousands of

sporozoites along with saliva into the bloodstream. In blood stream, these remain active for about half an hour and disappear from the blood circulation to enter into parenchymatous cells of liver.

Sporozoites in liver cell grow in size and multiply asexually (multiple fission) and forms thousands of merozoites. These get liberated out in the form of **cryptozoites or cryptomerozoites** through ruptured liver cell.

The cryptozoites infect the fresh liver cell where same process is repeated several times. The liberated merozoites in this phase are called **metacryptozoites.**
Some metacryptozoites are smaller in size called **micro-metacryptozoites** and some are larger in size called **macro-metacryptozoites.** Macro-metacryptozoites infects the fresh liver cells while single micro -metacryptozoites enter into a single red blood cells.

Micro-metacryptozoites pass through developmental stages to form **Erythrocytic-merozoites.** These Erythrocytic-merozoites infect fresh RBC and process is repeated.

After some generation of erythrocytic cycle, some of the merozoites invade the new RBC. They grow in size and develop into **gametocytes.** The gametocytes are of two types:
i. **Macrogametocytes or female gametocytes:** These are large (10-12µ) and numerous in number. They have reserved food materials

ii. **Microgametocytes or male gametocytes**: These are smaller (9-10 µ) motile and few in number. They lack reserved food.

These gametocytes get sucked by the female mosquito and in the gut of mosquito the develop into **Macrogametes (Female gamete)** and **Microgamete (Male gamete)**

These two gametes fuse to form **Zygote**. Zygote develops motility **(Ookinete)** and attaches to the wall of gut. This appears as blister on the gut wall called **oocyst.** Inside oocyst the zygote develops into several **sporozoites** which reach the saliva of mosquito to start the cycle afresh.

PLAGUE

Plague is a serious infectious disease caused by bacteria *Yersinia pestis* (Plague bacillus) and it spreads through bite with infected fleas. **Incubation Period:** 01 to 07 days

Types and Symptoms

Plague can be of three types

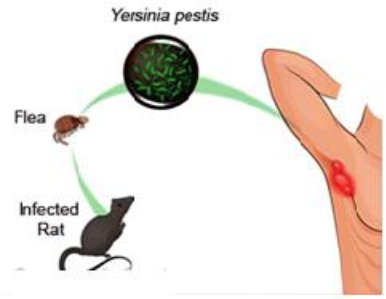
Bubonic Plague: It is most common form of plague. Its symptoms are- swollen lymph nodes in groin, arm pits and neck.

Pneumonic Plague: It affects respiratory system. Its symptoms are- Chest pain, shortness of breath, coughing with blood in cough.

Septicemic Plague: this type of plague is not very common. In this type the tissues turn black and die.

Common symptoms in all three type are- Fever, Chills, Headache, Fatigue, Muscle pain, Nausea Vomiting and Diarrhoea.

Transmission



The plague bacteria are present in small mammals and their fleas. It spreads by bite of infected vector flea. It also spreads by unprotected contact with infected material (Like body fluids and other contaminated materials) or through air via infectious droplets.

Bubonic and Septicemic plagues spread by flea bite or handling an infected animal

Pneumonic plague spreads through air via infectious droplets.

Diagnosis: Diagnosis is confirmed by looking for presence of plague bacteria in Lymph, Blood and Sputum.

Treatment: Plague is treated using combination of Anti-biotics and supportive care. Usually

combination of Gentamicin and fluoroquinolone is used. Risk of death is 70% if patient does not get treatment.

Prevention

Avoid flea bite.

Avoid unprotected handling of animal carcasses.

Avoid unprotected contact with infected body fluids/materials.

Samples from patients are cautiously collected.

FILARIASIS

Filariasis is parasitic helminthiases caused by roundworm. Eight different round worms are known to cause Filariasis in humans. The disease spreads by the bite of Black flies and Mosquitoes.

Types and Symptoms

Filariasis may be any one of possible three types

Lymphatic Filariasis: This is caused by worm Brugia malayi and Brugia timori. The worms occupy the lymph nodes and lymph vessels causing edema and thickening of skin and underlying tissues. This worm mainly affects the lower extremities causing Elephatiasis. It may also affect arms, breasts and scrotum.

Subcutaneous Filariasis: It is caused by worm Loa loa. The worm occupies fat layer below skin and causes rashes, urticarial papules, arthritis, Hypo or hyper pigmentation of skin. If eye gets affected then it causes blindness. This is major cause of blindness in the world.

Serous cavity Filariasis: It is caused by worm Mansonella ozzardi. This worm occupies the serous cavity in abdomen and presents symptoms similar to Subcutaneous Filariasis along with abdominal pain.

Transmission

The disease spreads from human to human by bite of Black flies and Mosquitoes.

Diagnosis

Filariasis is diagnosed by identifying Micro-filariae in blood smears or by anti-genic assay which detects circulating antigens.

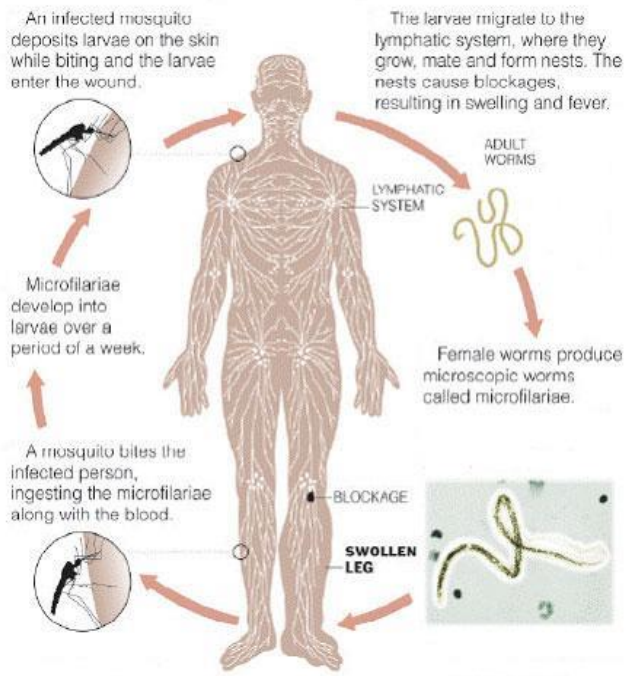
Treatment

Filariasis is treated by using combination of Anthelmintic drugs Albendazole and Ivermectin. Now Avermectin is used which makes better combination. Combination of diethyl carbamazine and Albendazole is also effective. Combining antibiotic Doxycycline with this treatment has been found to be useful.

Life Cycle

The female worm lays thousands of Micro-filariae. These micro-filariae are sucked by vector (Flies or Mosquitoes). In vector thes develop to infective larvae. During bite these infective larvae enter the human blood stream and develop to adult worm in about a year and the cycle restarts.

NOTE: Filariasis can affect domestic animal like Dogs, Horses and Sheep.



An infected mosquito deposits larvae on the skin while biting and the larvae enter the wound

Larvae migrate to the lymphatic system, where they grow, mate and form nests. The nests cause blockage resulting in swelling and fever

Female worm produces Microscopic worms called Micro-filariae

A mosquito bites the infected person ingesting the Micro-floriae along with the blood

Micro-filariae develop into larvae over a period of aweek.

SURFACE INFECTIONS

Skin is the largest organ of body and covers it externally. It is first line of defense against various infections. Sometimes even skin can get infected leading to mild or severe symptoms. Usually following four type of infections can occur in skin.

Bacterial Infections: Bacteria usually form a small red patch which may increase in size e.g. cellulitis, Boils and Leprosy. Usually topical and oral antibiotic are used to treat these infections.

Viral Infections: Viruses may cause mild to serious infections e.g. Chicken pox, Measles, Herpes and Warts. These are usually self limiting and require supportive treatment.

Fungal Infections: Fungal infections mainly affect the moist areas of skin (Groin, arm-pit and foot. E.g. Athlete's foot, Ring worm, Nail fungus and Diapers rash. Topical anti fungal preparation are used.

Parasitic Infection: These are caused by parasites present on the skin like Lice, Bed bug and Scabies. These may even lead to infection in blood stream.

RABIES

Rabies is caused by virus called Rabies virus. It is present in saliva of many animals most common being Dog.

Transmission

In humans it is caused by bite of animals like bite of Dog and Monkey. Even licking by these animals can cause rabies.

Symptoms

Initially headache and fever leading to excitation and delirium

Hydrophobia (Fear of water)

Respiratory paralysis

Rabies is a short duration disease and death may occur in 02 to 04 days.

Treatment

- The wound or scratch is washed with soap and plenty of water.
- Iodine tincture and Phenol is applied on the wound.
- Anti-rabies serum is applied on wound
- Person is administered ARV (Anti rabies vaccine)

Prevention

Animal bites are to be avoided

Infected animals are killed

Pets are immunized against rabies

TRACHOMA

Trachoma is an infectious disease caused by bacterium *Chlamydia trachomatis*. The infection causes a roughening of the inner surface of the eyelids. This roughening can lead to pain in the eyes, breakdown of the outer surface or cornea of the eyes, and eventual blindness.

Incubation period: 6 to 12 days,

Symptoms

- Conjunctivitis, or irritation in eyes
- Eye discharge
- Swollen eyelids
- Trichiasis (misdirected eyelashes)
- Swelling of lymph nodes in front of the ears
- Sensitivity to bright lights
- Increased heart rate
- Further ear, nose and throat complications.

The major complication or the most important one is corneal ulcer occurring due to rubbing by concentrations, or trichiasis with superimposed bacterial infection.

Blinding endemic trachoma results from multiple episodes of re-infection that maintains the intense inflammation in the conjunctiva.

Without re-infection, the inflammation will gradually subside.

Transmission

It is spread by direct contact with eye, nose, and throat secretions from affected individuals, or contact with fomities (inanimate objects that carry infectious agents), such as towels and/or washcloths.

Flies can also be a route of mechanical transmission.

Untreated, repeated trachoma infections result in entropion (the inward turning of the eyelids), which may result in blindness due to damage to the cornea.

Children spread the disease more often than adults, due to their tendency to get dirty easily.

Treatment

Azithromycin (single oral dose of 20 mg/kg) or topical tetracycline (one percent eye ointment)

Azithromycin is preferred because it can be used as a single oral dose

After scarring of the eyelid has occurred, surgery may be required to correct the position of the eyelashes and prevent blindness

Prevention

Efforts to prevent the disease include

Improving access to clean water

Treatment with antibiotics to decrease the number of people infected with the bacterium. This may include treating, all at once.

Washing the eyes repeatedly coupled with other measures is also useful.

TETANUS (Lock jaw)

Tetanus, also called lockjaw, is a serious infection caused by *Clostridium tetani.* The bacteria exist in soil, manure, and other environmental agents. A person who experiences a puncture wound with a contaminated object (Nails, Knives, Splinters and soiled tools) can develop the infection. This bacterium produces Exotoxin that affects the brain and nervous system, leading to stiffness in the muscles.

Incubation period: Tetanus symptoms usually emerge about 7 to 10 days after initial infection. However, this can vary from 4 days to about 3 weeks, and may, in some cases, may take months.

Symptoms

Muscle symptoms include spasms and stiffness. Stiffness usually starts with the chewing muscles, hence the name lockjaw. Muscle spasms then spread to the neck, throat, facial muscles and chest muscles leading to breathing difficulties and abdominal and limb movements

In severe cases, the spine may arch backward as the back muscles become affected. This is more common in children.

Most individuals with tetanus will also have the following symptoms:

- Bloody Stools
- Diarrhea
- Fever
- Headache
- Sensitivity To Touch
- Sore Throat
- Sweating
- Rapid Heartbeat

Any cut, wound or burn that is deep and has considerable piece of tissue removed, can develop tetanus. It must be thoroughly cleaned

and immediately treated to prevent the tetanus infection.

Any patient with such a wound should receive tetanus immunoglobulin (TIG) as soon as possible, even if they have been vaccinated. Tetanus immunoglobulin contains antibodies that kill *Clostridium tetani*. It is injected into a vein and provides immediate short-term protection against tetanus.

Antibiotics used for tetanus treatment are- Penicillin or Metronidazole. These antibiotics prevent the bacterium from multiplying and producing the neurotoxin that causes muscle spasms and stiffness. Even tetracycline may be used.

Patient may even be prescribed Anticonvulsants, such as diazepam (Valium), Muscle relaxants, such as baclofen, Neuromuscular blocking agents Pancuronium and Vecuronium.

Surgery

If the tetanus prone wound is very large, then surgery is performed to remove as much of the damaged and infected muscle as possible (debridement).

Prevention

Most cases of tetanus occur in people who have never had the vaccine or who did not have a booster shot within the previous decade. Maintaining personal hygiene and cleanliness of tools is always advantageous.

Vaccination

The tetanus vaccine is routinely given to children as part of DPT. Even Tetanus Toxoid can be used.

LEPROSY

Leprosy is an infectious disease that causes severe, disfiguring skin sores and nerve damage in the arms, legs, and skin areas around the body.

There was a time when it was considered as an incurable, mutilating, and contagious disease.

However, leprosy is actually not that contagious. One can catch it only upon coming into close and repeated contact with nose and mouth droplets from someone with untreated leprosy. Children are more likely to get leprosy than adults.

Causative organism

Leprosy is caused by a slow-growing type of bacteria called *Mycobacterium leprae* (*M. leprae*).

Incubation period: 03 to 05 years for symptoms to appear after coming into contact with the leprosy-causing bacteria. Some people may take up to 20 years to develop symptoms.

Symptoms

Leprosy primarily affects the skin and the nerves outside the brain and spinal cord, called the peripheral nerves. It may also strike the eyes and the thin tissue lining the inside of the nose.

The main symptom of leprosy is disfiguring skin sores, lumps, or bumps that do not go away after several weeks or months. The skin sores are pale-colored.

Nerve damage can lead to:

- Loss of feeling in the arms and legs
- Muscle weakness

Diagnosis

Leprosy can be recognized by appearance of patches on skin that may look lighter or darker than the normal skin. Sometimes the affected skin areas may be reddish. Loss of feeling in these skin patches is common. Patient may not feel a light touch or a prick with a needle.

- To confirm the diagnosis, biopsy of skin/nerve is done under microscope to look for the bacteria.

Treatment

Leprosy is treated with a combination of antibiotics. Typically, 2 or 3 antibiotics are used at the same time. These are dapsone with rifampicin, and clofazimine is added for some types of the disease. This is called multidrug therapy. This strategy helps prevent the development of antibiotic resistance by the bacteria, which may otherwise occur due to length of the treatment.

Treatment usually lasts between one to two years. The illness can be cured if treatment is completed as prescribed.

Several drugs are used in combination in multidrug therapy (MDT). These drugs must never be used alone as monotherapy for leprosy.

Dapsone, which is bacteriostatic or weakly bactericidal against *M. leprae*, was the mainstay treatment for leprosy for many years until widespread resistant strains appeared. Combination therapy has become essential to slow or prevent the development of resistance.

Rifampicin is now combined with **dapsone** to treat leprosy.

Rifampicin and clofazimine are now combined with **dapsone** to treat multibacillary leprosy.

A single dose of combination therapy has been used to cure single lesion paucibacillary leprosy: **rifampicin** (600 mg), **ofloxacin** (400 mg), and **minocycline** (100 mg). The child with a single lesion takes half the adult dose of the 3 medications.

Antibiotics used during the treatment will kill the bacteria that cause leprosy. But while the treatment can cure the disease and prevent it from getting worse, it does not reverse nerve damage or physical disfiguration that may have occurred before the diagnosis. Thus, it is very important that the disease be diagnosed as early as possible, before any permanent nerve damage occurs.

If left untreated, the nerve damage can result in paralysis and crippling of hands and feet. In very advanced cases, the person may have multiple injuries due to lack of sensation, and eventually the body may reabsorb the affected digits over time, resulting in the apparent loss of toes and fingers. Corneal ulcers or blindness can also occur if facial nerves are affected, due to loss of sensation of the cornea (outside) of the eye. Other signs of advanced leprosy may include loss of eyebrows and saddle-nose deformity resulting from damage to the nasal septum.

Prevention

The best way to prevent the spread of leprosy is the early diagnosis and treatment of people who are infected. For household contacts, immediate and annual examinations are recommended for at least five years after last contact with a person who is infectious.

NON-COMMUNICABLE DISEASES

A **non-communicable disease** (NCD) is a **disease** that is not transmissible directly from one person to another. These are also known as non-infectious diseases as these are not caused by microbes.

The four main types of non-communicable diseases include **cardiovascular disease**, cancer, chronic respiratory disease, and diabetes.

Other NCDs are-Parkinson's **disease**, autoimmune **diseases**, strokes, chronic kidney **disease**, osteoarthritis, osteoporosis, Alzheimer's **disease**, and cataract.

FACTORS CAUSING NCDS

They include age, gender, genetics, exposure to air pollution, and behaviours such as smoking, unhealthy diet and physical inactivity which can lead to hypertension and obesity, in turn leading to increased risk of many NCDs. Most NCDs are considered preventable because they are caused by modifiable risk factors.

HYPERTENSION

Hypertension (HTN or HT), also known as high blood pressure (HBP), is a long-term medical condition in which the blood pressure in the arteries is persistently elevated

Blood pressure measurements fall into four general categories:

- **Normal blood pressure.** Your blood pressure is normal if it's below 120/80 mm Hg.
- **Elevated blood pressure.** Elevated blood pressure is a systolic pressure ranging from 120 to 129 mm Hg and a diastolic pressure below 80 mm Hg. Elevated blood pressure tends to get worse over time unless steps are taken to control blood pressure.
    - **Stage 1 hypertension.** Stage 1 hypertension is a systolic pressure ranging from 130 to 139 mm Hg or a diastolic pressure ranging from 80 to 89 mm Hg.
    - **Stage 2 hypertension.** More severe hypertension, stage 2 hypertension is a systolic pressure of 140 mm Hg or higher or a diastolic pressure of 90 mm Hg or higher

Usually hypertension is defined as blood pressure above 140/90, and is considered severe if the pressure is above 180/120.

FACTORS CAUSING HYPERTENSION

Common factors that can lead to **high blood pressure** include: A diet high in salt, fat, and/or cholesterol. Chronic conditions such as kidney and hormone problems, diabetes, and high cholesterol

TYPES OF HYPERTENSION

High blood pressure is classified as primary (essential) hypertension or secondary hypertension.[5] About 90–95% of cases are primary, defined as high blood pressure due to nonspecific lifestyle and genetic factors. Lifestyle factors that increase the risk include excess salt in the diet, excess body weight, smoking, and alcohol use. The remaining 5–10% of cases are categorized as secondary high blood pressure, defined as high blood pressure due to an identifiable cause, such as chronic kidney disease, narrowing of the kidney arteries, an endocrine disorder, or the use of birth control pills.

Hypertension is rarely accompanied by symptoms, and its identification is usually through screening, or when seeking healthcare for an unrelated problem. Some people with high blood pressure report headaches (particularly at the back of the head and in the morning), as well as light headedness, vertigo, tinnitus (buzzing or hissing in the ears), altered vision or fainting episodes. These symptoms, however, might be related to associated anxiety rather than the

high blood pressure itself. Over time, if untreated, it can cause health conditions, such as heart disease and stroke.

PREVENTION AND TREATMENT

Changing your lifestyle can go a long way toward controlling high blood pressure. Your doctor may recommend you make lifestyle changes including:

- Eating a heart-healthy diet with less salt
- Getting regular physical activity
- Maintaining a healthy weight or losing weight if you're overweight or obese
- Limiting the amount of alcohol you drink
- Managing the level of stress in day to day life

But sometimes lifestyle changes aren't enough. In addition to diet and exercise, doctor may recommend medication to lower your blood pressure.

Category of medication your doctor prescribes depends on your blood pressure measurements and your other medical problems. It's helpful if you work together with a team of medical professionals experienced in providing treatment for high blood pressure to develop an individualized treatment plan.

Medications to treat high blood pressure

- **Thiazide diuretics.** Diuretics, sometimes called water pills, are medications that act on your kidneys to help your body eliminate sodium and water, reducing blood volume. Thiazide diuretics include chlorthalidone, hydrochlorothiazide (Microzide) and others.

  A common side effect of diuretics is increased urination.

- **Angiotensin-converting enzyme (ACE) inhibitors.** These medications — such as lisinopril (Zestril), benazepril (Lotensin), captopril (Capoten) and others — help relax blood vessels by blocking the formation of a natural chemical that narrows blood vessels. People with chronic kidney disease may benefit from having an ACE inhibitor as one of their medications.

- **Angiotensin II receptor blockers (ARBs).** These medications help relax blood vessels by blocking the action, not the formation, of a natural chemical that narrows blood vessels. ARBs include candesartan (Atacand), losartan (Cozaar) and others. People with chronic kidney disease may benefit from having an ARB as one of their medications.

- **Calcium channel blockers.** These medications — including amlodipine (Norvasc), diltiazem (Cardizem, Tiazac, others) and others — help relax the muscles of your blood vessels. Some slow your heart rate. Calcium channel blockers may work better for older people and people of African heritage than do ACE inhibitors alone.

  Grapefruit juice interacts with some calcium channel blockers, increasing blood levels of the medication and putting you at higher risk of side effects. Talk to your doctor or pharmacist if you're concerned about interactions.

To reduce the number of daily medication doses you need, your doctor may prescribe a combination of low-dose medications rather than larger doses of one single drug. In fact, two or more blood pressure drugs often are more effective than one. Sometimes finding the most effective medication or combination of drugs is a matter of trial and error.

DIABETES

Definition- Diabetes is a disease that occurs when blood glucose, also called blood sugar, is too high. Blood glucose is main source of energy and comes from the food. Insulin, a hormone made by the pancreas, helps glucose from food get into cells to be used for energy. Sometimes body doesn't make enough—or any—insulin or doesn't use insulin well. Glucose then stays in blood and doesn't reach cells.

TYPES OF DIABETES

The most common types of diabetes are type 1, type 2, and gestational diabetes.

Type 1 diabetes

It means that body does not make insulin. The immune system attacks and destroys the cells in pancreas that make insulin. Type 1 diabetes is usually diagnosed in children and young adults, although it can appear at any age. People with type 1 diabetes need to take insulin every day to stay alive.

Type 2 diabetes

It means that body does not make sufficient insulin or does not use insulin well. One can develop type 2 diabetes at any age, even during childhood. However, this type of diabetes occurs most often in middle-aged and older people. Type 2 is the most common type of diabetes.

Gestational diabetes

Gestational diabetes develops in some women when they are pregnant. Most of the time, this type of diabetes goes away after the baby is born. However, if you someone had gestational diabetes, then she has greater chance of developing type 2 diabetes later in life. Sometimes diabetes diagnosed during pregnancy is actually type 2 diabetes.

CAUSES OF DIABETES

Type 1 diabetes is caused by the immune system destroying the cells in the pancreas that make insulin. This causes diabetes by leaving the body without enough insulin to function normally. This is called an autoimmune reaction, or autoimmune cause, because the body is attacking itself. This may happen due to-

Bacterial or Viral infection

Presence of toxins within food

Genetic factors

Unknown factors

Type 2 diabetes is caused by many factors. Mainly family history is responsible for it.

Other factors are

Advancing age

Obesity

Following sedentary (Inactive or less physical activity) life style

Poor eating habits and unhealthy food

Certain chronic illnesses especially affecting pancreas (pancreatitis or pancreatic tumour or removal or surgery of pancreas)

Gestational diabetes: Causes for this diabetes are not clearly known. This may occur due to family history, obesity, and certain diseases of ovary. Some ethnic groups are more prone to this condition.

Some common causes of diabetes are

Resistance of cells towards insulin

Excessive secretion of certain hormones (Growth hormone, Corticosteroids, Glucagon and nor-adrenaline). These hormones antagonize action of insulin.

Excessive and prolonged use of steroids

Excessive consumption of alcohol

SYMPTOMS OF DIABETES

Common symptoms of diabetes are-

Polyuria (Increased in frequency of urination)

Polydyspia (Increased thirst)

Glycosuria (Presence of glucose in urine)

Ketoacidosis (Presence of ketone bodies in urine)

Polyphagia (Increased hunger)

Excessive weight loss, fatigue and blurred vision

Difficulty in healing wounds and cuts

How common is diabetes

As per estimate nearly 10% of total population has diabetes. More than 1 in 4 of them didn't know they have the disease. Diabetes affects 1 in 4 people over the age of 65. About 90-95% of cases in adults are type 2 diabetes.

Who is more likely to develop type 2 diabetes

Persons with 45 or older,

Persons having a family history of diabetes

Persons who are overweight

Persons having Physical inactivity

Certain health problems such as high blood pressure

Pre-diabetes (Before diabetes is diagnosed, there is a period when blood sugar levels are high but not high enough to be diagnosed as diabetes. This is known as pre-diabetes) or who had gestational diabetes

HEALTH PROBLEMS DEVELOPED BY DIABETICS

Over time, high blood glucose leads to problems such as

- Heart disease and Stroke
- Kidney disease
- Eye problems
- Dental disease
- Nerve damage
- Foot problems

These diabetes related problems can be avoided by keeping blood glucose level in check.

Although diabetes has no cure, one can take steps to manage diabetes and stay healthy.

STEPS TO PREVENT TYPE 2 DIABETES

Type 2 diabetes is a chronic disease that affects millions of people worldwide. It's estimated that up to 70% of people with pre-diabetes go on to develop type 2 diabetes.

1. **Cut Sugar and Refined Carbohydrates from Diet:** Consuming sugar and refined carbohydrates shoot up glucose level as these get absorbed quickly

2. Work Out Regularly: Exercise increases the insulin sensitivity of cells. Hence less insulin is required to keep blood sugar levels under control.

3. Drink Water as Your Primary Beverage: Water is the most natural beverage. Drinking water most of the time helps avoiding beverages that are high in sugar, preservatives and other questionable ingredients

4. Lose Weight If Overweight or Obese: Obesity means fat and the fat increases resistance to insulin.

5. Quit Smoking: Smoking is related to many other problems also

6. Follow a Very-Low-Carb Diet: Low carbohydrate diet reduces spikes in glucose level and also helps in reducing weight.

7. Watch Portion Sizes: It means having low quantity of food at a time. Numbers of low meals are better than

two full meals. This helps avoiding spikes in blood glucose level.

8. **Avoid Sedentary Behaviour:** Exercise helps consuming the blood glucose hence reducing its blood level.
9. **Eat a High-Fibre Diet:** Getting plenty of fibre is beneficial for gut health and weight management. It also helps in slow absorption of glucose from g.i.t.
10. **Optimize Vitamin D Levels:** It has been found that Vitamin D is important for blood sugar control.
11. **Minimize Intake of Processed Foods:** One clear step you can take to improve your health is to minimize your consumption of processed foods.
12. **Drink Coffee or Tea:** Although water should be one's primary beverage but research suggests that including coffee or tea in diet may help avoid diabetes.
13. **Consume Natural Herbs:** Some herbs increase insulin sensitivity and reduce the likelihood of diabetes progression. Two examples are-

Turmeric- Turmeric has Curcumin. It has strong anti-inflammatory properties and increases insulin sensitivity and improved functioning of insulin-producing cells in the pancreas.

Berberis- Berberis contains Berberine.It works by increasing insulin sensitivity and reducing the release of sugar by the liver.

ASTHMA

Asthma is a condition in which airways get narrowed and swell and produce extra mucus. This can make breathing difficult and trigger coughing, wheezing and shortness of breath.

For some people, asthma is a minor nuisance. For others, it is a major problem that interferes with daily activities and may lead to a life-threatening asthma attack.

Classification of Asthma

The National Asthma Education and Prevention Program has classified asthma as:

- Intermittent.
- Mild persistent.
- Moderate persistent.
- Severe persistent.

This classification is based on severity, which is determined by symptoms and lung function tests.

Intermittent asthma

Asthma is considered intermittent if without treatment any of the following are true:

Symptoms (difficulty breathing, wheezing, chest tightness, and coughing):

Occur on fewer than 2 days a week.

Do not interfere with normal activities.

Night time symptoms occur on fewer than 2 days a month.

Lung function tests (spirometry and peak expiratory flow [PEF]) are normal when the person is not having an asthma attack.

Mild persistent asthma

Asthma is considered mild persistent if without treatment any of the following are true:

Symptoms occur on more than 2 days a week but do not occur every day.

Attacks interfere with daily activities.

Night time symptoms occur 3 to 4 times a month.

Lung function tests are normal when the person is not having an asthma attack.

Moderate persistent asthma

Asthma is considered moderate persistent if without treatment any of the following are true:

Symptoms occur daily. Inhaled short-acting asthma medication is used every day.

Symptoms interfere with daily activities.

Night time symptoms occur more than 1 time a week, but do not happen every day.

Lung function tests are abnormal (more than 60% to less than 80% of the expected value),

Severe persistent asthma

Asthma is considered severe persistent if without treatment any of the following are true:

Symptoms:

Occur throughout each day.

Severely limit daily physical activities.

Night time symptoms occur often, sometimes every night.

Lung function tests are abnormal (60% or less of expected value).

Asthma symptoms vary from person to person. One may have infrequent asthma attacks, have symptoms only at certain times — such as when exercising — or have symptoms all the time.

Asthma signs and symptoms include:

Shortness of breath

- Chest tightness or pain
- Trouble sleeping caused by shortness of breath, coughing or wheezing
- A whistling or wheezing sound when exhaling (wheezing is a common sign of asthma in children)
- Coughing or wheezing attacks that are worsened by a respiratory virus, such as a cold or the flu

Following conditions suggest that asthma condition is worsening

- Asthma signs and symptoms that are more frequent and bothersome
- Increasing difficulty breathing (measurable with a peak flow meter, a device used to check how well your lungs are working)
- The need to use a quick-relief inhaler more often

RISK FACTORS

A number of factors are thought to increase your chances of developing asthma. These include:

- Having a blood relative (such as a parent or sibling) with asthma
- Having another allergic condition, such as atopic dermatitis or allergic rhinitis (hay fever)
- Being overweight
- Being a smoker
- Exposure to second hand smoke
- Exposure to exhaust fumes or other types of pollution
- Exposure to occupational triggers, such as chemicals used in farming, hairdressing and manufacturing

Asthma can't be cured, but its symptoms can be controlled. Because asthma often changes over time, it's important that you work with your doctor to track your signs and symptoms and adjust treatment as needed.

Asthma triggers

Exposure to various irritants and substances that trigger allergies (allergens) can trigger signs and symptoms of asthma. Asthma triggers are different from person to person and can include:

- Airborne substances, such as pollen, dust mites, mold spores, pet dander or particles of cockroach waste
- Respiratory infections, such as the common cold
- Physical activity (exercise-induced asthma)
- Cold air
- Air pollutants and irritants, such as smoke
- Certain medications, including beta blockers, aspirin, ibuprofen
- Strong emotions and stress
- Sulfites and preservatives added to some types of foods and beverages, including shrimp, dried fruit, processed potatoes, beer and wine
- Gastro-esophageal reflux disease (GERD), a condition in which stomach acids back up into your throat

CAUSES

It isn't clear why some people get asthma and others don't, but it's probably due to a combination of environmental and genetic (inherited) factors.

PREVENTION

While there's no way to prevent asthma, by working together, you and your doctor can design a step-by-step plan for living with your condition and preventing asthma attacks.

- **Follow your asthma action plan.** Understand and follow the detailed plan for taking medications and managing an asthma attack.
- **Get vaccinated for influenza and pneumonia.** Staying current with vaccinations can prevent flu and pneumonia from triggering asthma flare-ups.
- **Identify and avoid asthma triggers.** A number of outdoor allergens and irritants — ranging from pollen and mould to cold air and air pollution — can trigger asthma attacks. Patient should find out what causes or worsens his/her asthma, and take steps to avoid those triggers.
- **Monitor your breathing.** Airflow may be measured daily to judge condition..
- **Identify and treat attacks early.** One should be able to recognize warning signs of an impending attack, such as slight coughing, wheezing or shortness of breath. If the patient acts quickly, then he/she is less likely to have a severe attack and won't need much medication to control your symptoms.
- **Take your medication as prescribed.** Patient should take the medication regularly even if asthma seems to be improving.
- **Pay attention to increasing quick-relief inhaler use.** If a patient finds that dependence on quick-relief inhaler, is increasing; it means that asthma condition is worsening. Physician should be immediately consulted.

For some people, asthma signs and symptoms flare up in certain situations:

- **Exercise-induced asthma,** which may be worse when the air is cold and dry
- **Occupational asthma,** triggered by workplace irritants such as chemical fumes, gases or dust
- **Allergy-induced asthma,** triggered by airborne substances, such as pollen, mold spores, cockroach waste or particles of skin and dried saliva shed by pets (pet dander)

COMPLICATIONS

Asthma complications include:

- Signs and symptoms that interfere with sleep, work or recreational activities

- Sick days from work or school during asthma flare-ups
- Permanent narrowing of the bronchial tubes (airway remodeling) that affects how well you can breathe
- Emergency room visits and hospitalizations for severe asthma attacks
- Side effects from long-term use of some medications used to stabilize severe asthma

Proper treatment makes a big difference in preventing both short-term and long-term complications caused by asthma.

PEPTIC ULCERS

Peptic ulcers are sores that develop in the lining of the stomach, lower oesophagus, or small intestine. They're usually formed as a result of inflammation caused by the bacteria *H. pylori*, as well as from erosion from stomach acids. Peptic ulcers are a fairly common health problem.

TYPES OF PEPTIC ULCERS:

- **gastric ulcers:** ulcers that develop inside the stomach
- **esophageal ulcers:** ulcers that develop inside the esophagus
- **duodenal ulcers:** ulcers that develop in the upper section of the small intestines, called the duodenum

CAUSES OF PEPTIC ULCERS

Different factors can cause the lining of the stomach, the oesophagus, and the small intestine to break down. These include:

- *Helicobacter pylori* (*H. pylori*), a type of bacteria that can cause a stomach infection and inflammation
- frequent use of aspirin (Bayer), ibuprofen (Advil), and other anti-inflammatory drugs (risk associated with this behavior increases in women and people over the age of 60)
- smoking
- drinking too much alcohol
- radiation therapy
- stomach cancer

SYMPTOMS OF PEPTIC ULCERS

Small peptic ulcers may not produce any symptoms in the early phases. The most common symptom of a peptic ulcer is burning abdominal pain that extends from the navel to the chest, which can range from mild to severe. In some cases, the pain may wake up the patient at night. Other common signs of a peptic ulcer include:

- changes in appetite
- nausea
- bloody or dark stools
- unexplained weight loss
- indigestion
- vomiting
- chest pain

TREATMENT OF PEPTIC ULCER

Treatment depends upon the underlying cause of ulcer. If tests show that cause is *H. pylori* infection, then ant acid along with antibiotics are prescribed.

If cause is not *H. pylori* infection, then only antacids are prescribed.

Acid blockers like ranitidine and famotidine are also prescribed to reduce stomach acid and ulcer pain. Sucralfate (is used to coat stomach so as to reduce symptoms of peptic ulcers.

COMPLICATIONS OF A PEPTIC ULCER

Untreated ulcers can become worse over time. These can lead to other more serious health complications such as:

- **Perforation:** A hole develops in the lining of the stomach or small intestine and causes an infection. A sign of a perforated ulcer is sudden, severe abdominal pain.
- **Internal bleeding:** Bleeding ulcers can result in significant blood loss and thus require hospitalization. Signs of a bleeding ulcer include light headedness, dizziness, and black stools.
- **Scar tissue:** This is thick tissue that develops after an injury. This tissue makes it difficult for food to pass through your digestive tract. Signs of scar tissue include vomiting and weight loss.

All three complications are serious and may require surgery hence a patient should seek urgent medical attention if he/she experiences the following symptoms:

- sudden, sharp abdominal pain
- fainting, excessive sweating, or confusion, as these may be signs of shock
- blood in vomit or stool
- abdomen that's hard to the touch
- abdominal pain that worsens with movement but improves with lying completely still

HOW TO PREVENT PEPTIC ULCERS

Certain lifestyle choices and habits can reduce your risk of developing peptic ulcers. These include:

- not drinking more than two alcoholic beverages a day
- not mixing alcohol with medication
- washing your hands frequently to avoid infections
- limiting your use of ibuprofen, aspirin, and naproxen (Aleve)

Maintaining a healthy lifestyle by quitting smoking cigarettes and other tobacco use and eating a balanced diet rich in fruits, vegetables, and whole grains will help you prevent developing a peptic ulcer.

EPILEPSY

Epilepsy is a central nervous system (neurological) disorder in which electrical activity in brain becomes abnormal, causing seizures or periods of unusual behaviour, sensations, and sometimes loss of awareness (Unconsciousness)

Seizure symptoms can vary widely. Some people with epilepsy simply stare blankly for a few seconds during a seizure, while others repeatedly twitch their arms or legs. Having a single seizure doesn't mean you have epilepsy. At least two unprovoked seizures are generally required for an epilepsy diagnosis.

Treatment with medications or sometimes surgery can control seizures for the majority of people with epilepsy. Some people require lifelong treatment to control seizures, but for others, the seizures eventually go away. Some children with epilepsy may outgrow the condition with age.

Symptoms

Because epilepsy is caused by abnormal activity in the brain, seizures can affect any process your brain coordinates. Seizure signs and symptoms may include:

- Temporary confusion
- A staring spell
- Uncontrollable jerking movements of the arms and legs
- Loss of consciousness or awareness

- Psychic symptoms such as fear, anxiety or déjà vu (An anomaly of memory where patient thinks that he/she has lived through the present situation even before)

Symptoms vary depending on the type of seizure. In most cases, a person with epilepsy will tend to have the same type of seizure each time, so the symptoms will be similar from episode to episode.

Doctors generally classify seizures as either focal or generalized, based on how the abnormal brain activity begins.

Focal seizures

When seizures appear to result from abnormal activity in just one area of your brain, they're called focal (partial) seizures. These may occur with of without loss of consciousness:

Generalized seizures

Seizures that appear to involve all areas of the brain are called generalized seizures. These seizures cause stiffening of muscles, cause a loss of muscle control, repeated or rhythmic jerking muscle movements with or without loss of consciousness.

Causes

Epilepsy has no identifiable cause in about half the people with the condition. In the other half, the condition may be traced to various factors, including:

- **Genetic influence.** Some types of epilepsy, which are categorized by the type of seizure one experiences or the part of the brain that is affected, run in families. In these cases, it's likely that there's a genetic influence.
- **Head trauma.** Head trauma as a result of a car accident or other traumatic injury can cause epilepsy.
- **Brain conditions.** Brain conditions that cause damage to the brain, such as brain tumours or strokes, can cause epilepsy. Stroke is a leading cause of epilepsy in adults older than age 35.
- **Infectious diseases.** Infectious diseases, such as meningitis, AIDS and viral encephalitis, can cause epilepsy.
- **Prenatal injury.** Before birth, babies are sensitive to brain damage that could be caused by several factors, such as an infection in the mother, poor nutrition or oxygen deficiencies. This brain damage can result in epilepsy or cerebral palsy.
- **Developmental disorders.** Epilepsy can sometimes be associated with developmental disorders, such as autism and neurofibromatosis.

Risk factors

Certain factors may increase your risk of epilepsy:

- **Age.** The onset of epilepsy is most common in children and older adults, but the condition can occur at any age.
- **Family history.** If you have a family history of epilepsy, you may be at an increased risk of developing a seizure disorder.
- **Head injuries.** Head injuries are responsible for some cases of epilepsy. You can reduce your risk by wearing a seat belt while riding in a car and by wearing a helmet while bicycling, skiing, riding a motorcycle or engaging in other activities with a high risk of head injury.
- **Stroke and other vascular diseases.** Stroke and other blood vessel (vascular) diseases can lead to brain damage that may trigger epilepsy. You can take a number of steps to reduce your risk of these diseases, including limiting your intake of alcohol and avoiding

cigarettes, eating a healthy diet, and exercising regularly.

- **Dementia.** Dementia can increase the risk of epilepsy in older adults.
- **Brain infections.** Infections such as meningitis, which causes inflammation in your brain or spinal cord, can increase your risk.
- **Seizures in childhood.** High fevers in childhood can sometimes be associated with seizures. Children who have seizures due to high fevers generally won't develop epilepsy. The risk of epilepsy increases if a child has a long seizure, another nervous system condition or a family history of epilepsy.

COMPLICATIONS

Having a seizure at certain times can lead to circumstances that are dangerous to yourself or others.

- **Falling.** If you fall during a seizure, you can injure your head or break a bone.
- **Drowning.** Person with epilepsy, has 15 to 19 times more likely to drown while swimming or bathing.
- **Accidents while driving or operating machinery.** A seizure that causes either loss of awareness or control can be dangerous if you're driving a car or operating other equipment.
- **Pregnancy complications.** Seizures during pregnancy pose dangers to both mother and baby, and certain anti-epileptic medications increase the risk of birth defects.
- **Emotional health issues.** People with epilepsy are more likely to have psychological problems, especially depression, anxiety and suicidal thoughts and behaviours.

Seizures of Epilepsy can be prevented by identifying the triggers and avoiding the same. Some common preventive steps are-

- Get plenty of sleep each night — set a regular sleep schedule, and stick to it.
- Learn stress management and relaxation techniques.
- Avoid drugs and alcohol.
- Take all medications as prescribed by doctor.
- Avoid bright, flashing lights and other visual stimuli.
- Skip TV and computer time whenever possible.
- Avoid playing video games.
- Eat a healthy diet.

If above steps are followed then these can make a measurable difference in the number of seizures one has.

CANCER

Cancer is a group of diseases involving abnormal cell growth. The abnormal cell growth forms a group of cells called tumour (Also called NEOPLASM). This tumour undergoes unregulated growth and will often form a mass or lump, with the potential to invade or spread to other parts of the body. These contrast with benign tumours, which do not spread. Possible signs and symptoms include

- A Lump
- Abnormal Bleeding
- Prolonged Cough
- Unexplained Weight Loss
- Change in Bowel Movements

While these symptoms may indicate cancer, they can also have other causes.

Over 100 types of cancers affect humans.

CLASSIFICATION

Cancers are classified depending upon from which type od cells these develop.

- **Carcinoma:** Cancers derived from epithelial cells e.g. Cancers of the breast, Prostrate, Lung, Pancreas and colon.
- **Sarcoma:** Cancers arising from connective tissue e.g. cancers of bone, cartilage, fat, nerve),
- **Lymphoma and leukaemia:** These two classes arise from hematopoietic (blood-forming) cells that leave the marrow and tend to mature in the lymph nodes and blood, respectively.
- **Germ cell tumour:** Cancers derived from testicle or the ovary
- **Blastoma:** Cancers derived from embryonic tissue.

CAUSES OF CANCER

- Smoking of Tobacco is the cause of about 22% of cancer deaths
- Obesity, poor diet, lack of physical activity
- Excessive drinking of alcohol
- Infections (Hepatitis, HIV), exposure to ionizing radiation and environmental pollutants
- Heredity

These factors act, at least partly, by changing the genes of a cell.

DIAGNOSIS

Cancer can be detected by certain signs and symptoms or screening tests. It is then typically further investigated by medical imaging and confirmed by biopsy.

TREATMENT

For the treatment of cancer many options are available. Some common options are-

- Surgery
- Chemotherapy
- Radiation Therapy
- Hormonal Therapy
- Targeted Therapy
- Palliative Care
- Alternative medicine

Treatment selected depends on the type, location and grade of the cancer as well as the patient's health and preferences. The treatment intent may or may not be curative.

Surgery: Surgery is the primary method of treatment for most localized or isolated, solid cancers and may play a role in palliation and prolongation of survival. For some types of cancer this is sufficient to eliminate the cancer.

Chemotherapy: Chemotherapy is the treatment of cancer with one or more cytotoxic anti-neoplastic drugs (chemotherapeutic agents) as part of a standardized regimen. The term encompasses a variety of drugs, which are divided into broad categories such as alkylating agents and antimetabolites. Traditional chemotherapeutic agents act by killing cells that divide rapidly, a critical property of most cancer cells.

Radiation: Radiation therapy involves the use of ionizing radiation in an attempt to either cure or improve symptoms. It works by damaging the DNA of cancerous tissue, killing it. To spare normal tissues (such as skin or organs, which radiation must pass through to treat the tumour), shaped radiation beams are aimed from multiple exposure angles to intersect at the tumour, providing a much larger dose there than in the surrounding, healthy tissue.

Hormonal therapy: Some cancers use hormones to grow or develop. This means the cancer is hormone sensitive or hormone dependent. Hormone therapy for cancer uses medicines to block or lower the amount of hormones in the body to stop or slow down the

growth of cancer. It does not work for all cancers. It is useful for-

- breast cancer
- prostate cancer
- ovarian cancer
- womb cancer (also called uterine or endometrial cancer)

Targeted therapy: Targeted therapy is a form of chemotherapy that targets specific molecular differences between cancer and normal cells. The first targeted therapies blocked the oestrogen receptor molecule, inhibiting the growth of breast cancer. Currently, targeted therapies exist for many of the most common cancer types, including bladder cancer, breast cancer, kidney cancer, leukaemia, liver cancer, lung cancer, lymphoma, pancreatic cancer, prostate cancer, skin cancer, and thyroid cancer as well as other cancer types.

Palliative care: Palliative care is treatment that attempts to help the patient feel better and may be combined with an attempt to treat the cancer. Palliative care includes action to reduce physical, emotional, spiritual and psycho-social distress. Unlike treatment that is aimed at directly killing cancer cells, the primary goal of palliative care is to improve quality of life.

Alternative medicine: Complementary and alternative cancer treatments are a diverse group of therapies, practices and products that are not part of conventional medicine. "Complementary medicine" refers to methods and substances used along with conventional medicine, while "alternative medicine" refers to compounds used instead of conventional medicine. Most complementary and alternative medicines for cancer have not been studied or tested using conventional techniques such as clinical trials. Some alternative treatments have been investigated and shown to be ineffective but still continue to be marketed and promoted.

PREVENTION

Many cancers can be prevented by

Not smoking Tobacco,

Maintaining a healthy weight

Not drinking too much alcohol

Eating plenty of vegetables, fruits and whole grains, and not eating too much processed and red meat

Vaccination against certain infectious diseases,

Avoiding too much sunlight exposure

Early detection and treatment also helps in avoiding many complications.

EPIDEMIOLOGY, IMMUNITY, HAIs and DISINFECTION

Definition: Epidemiology is the study of disease in populations and of factors that determine its occurrence over time. Or

It is the branch of medicine which deals with the incidence, distribution, and possible control of diseases and other factors relating to health. Or

Epidemiology is concerned with the **distribution** and **determinants** of health and disease, **morbidity**, injury, disability, and **mortality** in **populations.**

Distribution implies that diseases and other health outcomes do not occur randomly in populations; **determinants** are any factors that cause a change in a health condition or other defined characteristic; **morbidity** is illness due to a specific disease or health condition; **mortality** is death due to a specific disease or health condition; and the **population at risk** can be people, animals, or plants. Or

Epidemiology is the study of health state and their distribution in a specified population and application of this study in control of Disease(s)

Health state means infection, Illness, Morbidity, mortality and survival. In epidemiology we correlate these health states with the frequency and pattern of disease. Frequency means the number of times the disease occurs in a given time period while pattern means the behaviour of disease during each occurrence. Frequency and Pattern are both affected by 'risk factors' and 'Protective factors'. Epidemiology also includes the evaluation of therapeutic (Medicine) and Prophylactic (Vaccine, Hygiene and Food habits) interventions. Efficacy of these interventions can be studied under controlled conditions or through a routine delivery system.

Epidemiology makes clear the risk factors and value of each intervention, which is then used in framing future policies for improving and protecting the health of public.

SCOPE OF EPIDEMIOLOGY

Scope of Epidemiology includes-

- To study number of incidences, distribution and progression of disease
- To collect data regarding health status of population
- To collect data regarding causes for occurrence of disease
- Use of collected data for promoting the health of population.

BASIC PRINCIPLES OF EPIDEMIOLOGY

Epidemiologic Terms and Concepts

The **natural history** of a disease in a population, sometimes termed the disease's ecology, refers to the course of the disease from its beginning to its final clinical endpoints. The natural history begins before infection (pre-pathogenesis period) when the agent simply exists in the environment, includes the factors that affect its incidence and distribution, and concludes with either its disappearance or persistence (endemnicity) in that environment.

An important epidemiologic concept is that neither health nor disease occurs randomly throughout populations. Many factors influence the temporal waxing and waning of disease. A disease is considered **endemic** when it is constantly present within a given geographic area. For instance, animal rabies is endemic in the USA. An **epidemic** occurs when a disease occurs in larger numbers than expected in a given population and geographic area. Raccoon rabies was epidemic throughout the eastern USA for much of the 1980s and 1990s. A

subset of an epidemic is an **outbreak**, when the higher disease occurrence occurs in a smaller geographic area and shorter period of time. Finally, a **pandemic** occurs when an epidemic becomes global in scope (e.g., influenza, HIV/AIDS). Latest being COVID-19.

EPIDEMIOLOGIC TRIANGLE

Scientists have developed a model to study the health problems. This model is termed as EPIDEMIOLOGIC TRIANGLE

The epidemiologic triangle is made up of three parts: agent, host and environment.

Agent- The agent is the microorganism that actually causes the disease in question.

Host-The agent infects the host, which is the organism that carries the disease.

Environment- It means surrounding which connects other two parts

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The **population at risk** is an extremely important concept in epidemiology and includes members of the overall population who are capable of developing the disease or condition being studied. This concept seems simple at first, but misinterpretations can lead to erroneous study results and conclusions. As a simple example, a study of testicular cancer should not include women in the population.

A **ratio** is the value obtained from dividing one quantity by another (X/Y). The numerator and denominator may be independent of each other. A **proportion** is a type of ratio in which the numerator is part of the denominator (A/[A + B]).

A **rate** is another type of ratio in which the denominator involves the passage of time. This is important in epidemiology, because rates can be used to measure the speed of a disease event or to make epidemiologic comparisons between populations over time.

STUDY METHODS IN EPIDEMIOLOGY

An epidemiologist studies the occurrence of disease in population and factors which lead to its spread or control. These studies can be divided into OBSERVATIONAL STUDIES and EXPERIMENTAL STUDIES.

OBSERVATIONAL STUDIES

In observational studies the investigator records the data without any interference in progress of disease. These studies are further divided into DESCRIPTIVE and ANALYTICAL STUDIES

Descriptive studies: these studies record the incidence of disease and the distribution of disease and health related factors in human population. Procedure involved in this study is as follows-

Describing the population under study

Describing the disease under study

Measurement of disease in terms of Morbidity, Disability and Mortality

In the end correlation of risk and health factors

Descriptive studies help in correlating diseases to causes (Smoking to cancer, contaminated water to gastric problems) and help calculating morbidity and mortality rate and ratio

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In short the descriptive epidemiology serves to describe the occurrence of disease in a population. Descriptive methods are commonly applied to little-known diseases; they use pre-existing data, address the questions of who/where/when, and identify potential associations for more in-depth analytical studies.

Analytical Epidemiology

Analytical studies are applied to study the etiology of disease, to identify a causal

relationship between exposures and health outcomes. They are typically used when insights of a particular health issue are available, commonly from previous descriptive studies. In evaluating the causality of disease associations, analytical studies address the question of "why" as opposed to the "person/place/time" of descriptive studies.

Once potential associations have been observed between those who have a particular disease and those who do not, further investigations are undertaken to determine causality and identify effective interventions. The first step in an analytic study is to form some conjecture regarding observed exposures and health outcomes. In analytical studies, this conjecture is termed the **null hypothesis**, meaning that the default assumption is that there is no association between the exposure in question and the disease outcome. Note that this assumption of no association is made even though the epidemiologist often thinks that some association actually exists. Once the null hypothesis is generated, studies are designed to test it and either reject it (by finding that some association actually does exist between exposure and disease outcome) or accept it (by finding that no association exists).

Analytical epidemiology is accomplished through either observational studies or interventional studies. In the former, the investigator does not control the exposure between the groups under study and typically cannot randomly assign subjects to study groups.

EXPERIMENTAL STUDIES

Experimental study is a type of epidemiological investigation that uses an experimental model to confirm a causal relationship suggested by observational studies. It studies the relationships of various factors determining the frequency and distribution of diseases in a community.

CASE TYPES

There are three case types in experimental epidemiology:

Randomized controlled trial: It is typically used for new medicine or drug testing;

Field trial: It is generally conducted on group of population who are at high risk of contracting a disease.

Community trial: in this study research is conducted on an entire community or neighbourhood. Randomized controlled trial determines the efficacy of a particular treatment, while other trials may be preventive intervention.

Experimental epidemiology employs prospective population experiments designed to test epidemiological hypotheses, and usually attempts to relate the postulated cause to the observed effect. Trials of new anthelmintic are an example. Similarly intervention or experimentation involves attempting to change a variable in one or more groups of people. This could mean eliminating a dietary factor thought to cause allergy, or testing a new treatment on a selected group of patients. The effects of an intervention are measured by comparing the result in the experimental group with that in a control group.

DISEASE TRANSMISSION

Spread of infectious or communicable disease starts from reservoir. These reservoirs pass on the infection to the susceptible host. Reservoir may be a person, animal, arthropod, plant, soil or combination of these.

Human reservoir may be a person with symptoms of disease or simply a carrier (person with infection but without any symptoms of disease). Examples of animal reservoir are stray dogs and birds causing rabies and bird flu. Non animal reservoirs are various surfaces, linen, cloth and soil. Soil has eggs and larvae of various worms and spores of tetanus. Rusted

iron surface can also be contaminated with tetanus spores.

TRANSMISSION

Transmission of disease means spread of infection from reservoir to susceptible host. It occurs through various routes which are categorised into DIRECT TRANSMISSION and INDIRECT TRANSMISSION.

DIRECT TRANSMISSION: It means physical contact with infected person or a carrier, droplet infection, bite of an animal and from mother to unborn child through trans-placental passage.

INDIRECT TRANSMISSION: It means that infecting agent survives outside human body and reaches host via some agent. It can be air, water and fomite borne, mediated through vector (Mosquitoes), unclean hands and fingers and vehicle borne (blood and blood products)

APPLICATIONS OF EPIDEMIOLOGY

Epidemiologists are public health professionals who investigate patterns and causes of disease and injury in humans. They seek to reduce the risk and occurrence of negative health outcomes through research, community education and health policy

Epidemiology is applied in many areas of public health practice. Among the most salient are to observe historical health trends to make useful projections into the future, discover (diagnose) current health and disease burden in a population, identify specific causes and risk factors of disease, differentiate between natural and intentional events (e.g., bioterrorism), describe the natural history of a particular disease, compare various treatment and prevention products/techniques, assess the impact/efficiency/cost/outcome of interventions, prioritize intervention strategies, and provide foundation for public policy.

IMMUNITY AND IMMUNISATION

Immunity is defined as **'resistance to the attack of micro-organisms'**. It is studied under Immunology, which is defined as the **'Science of Immunity'**

Immunology may also be defined as the science which is concerned with the specific mechanism, by which living tissues react to presence of foreign biological material; in a way that resistance or immunity develops. The various technical terms used in immunology are-

PATHOGENICITY: It means the **ability** of micro-organisms to cause disease. This includes the entry of micro-organism into the body of the host, its establishment in some tissue(s) and finally giving rise the symptoms of disease.

INFECTION: if a micro-organism gets entry into the body of host, establishes in some tissue and start producing symptoms of disease, then infection is said to have occurred. The disease so produced is called **'Infectious disease'**.

VIRULENCE: Virulence is defined as the **power** to produce harmful effects to the body of host. A micro-organism produces harmful effects, in following two ways-

(i) **By Mechanical Destruction:** Upon multiplication in the tissue, the micro-organism causes mechanical destruction by rupturing the cells. This destruction of cells disturbs the normal functioning of cells.

(ii) **By Producing Toxins:** Due to their normal metabolism, the micro-organisms; produce toxins (Poisonous substances) and these have harmful effects on the body of host. These toxins are Exotoxins or Endotoxins.

   (a) **Exotoxins:** These toxins are metabolic products of micro-organisms and these pass through

bacterial cell to the surroundings. Exotoxins are highly toxic to the tissue of the host.

(b) **Endotoxin:** these toxins are the structural parts of the bacterial cell and are liberated to the tissues of host only after the death of the bacterial cell. These toxins are comparatively less toxic to the tissues of the host.

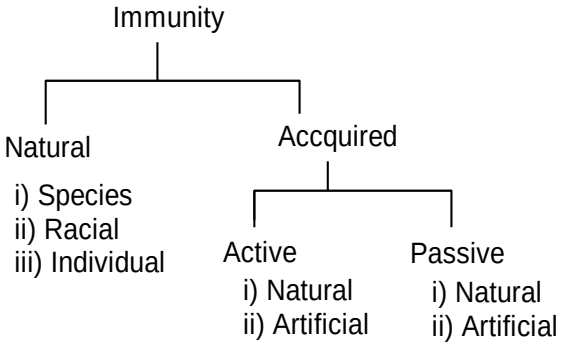
ANTIGEN: These are the protein substances in the bacterial cell and induce production of 'ANTIBODIES' in the body of host. A single cell of bacterium may have several antigens. The **capacity** of these antigens to induce production of antibodies is called '**ANTIGENICITY'.**

VACCINES: preparations containing either products of micro-organisms or micro-organisms themselves; which can serve as antigens are known as VACCINES. Vaccines are also defined as preparations containing antigens.

SERA (SERUM): PREPARATIONS containing ANTIBODIES are known as sera.

IMMUNITY

Immunity is the state of individual whereby it resists or is non susceptible to the attack of micro-organisms or infection. In can be classified as below-



NATURAL IMMUNITY

This type of immunity is due to the constitutional make up (Body make up or genetic make up). This state is inherited in the cells of the body of the host.

i) **Species:** It means that a particular disease occurs in some living beings but not in others e.g. Tuberculosis and Rabies occur in both- men and animals but disease like Syphilis, Measles, Leprosy never occur in animals.

ii) **Racial:** It means that a particular disease occurs in some race of a species but not in other race e.g. the Negroes can resist highly the Yellow fever but not the Tuberculosis. Similarly the Europeans can resist highly the Tuberculosis but not the Yellow fever.

iii) **Individual:** It means that a particular individual is immune to a disease e.g. it is a well known fact that certain individuals are more resistant to cold and skin infections and other conditions.

ACQUIRED IMMUNITY

This type of immunity develops during the life time of the individual. This immunity may develop in response to a stimulus (An infection or injections of vaccine) or by administration of ANTI-BODIES produced in some other individual. Immunity of 1st type is called ACTIVE ACCQUIRED IMMUNITY while that of second type is called PASSIVE ACCQUIRED IMMUNITY.

ACTIVE ACQUIRED IMMUNITY

In this type of immunity, the body of a person develops immunity (Anti-bodies) in response to antigen. It can be of following two types-

i) **Natural Active Acquired Immunity**: This type of immunity develops in response to a infection in a routine way. The infection can be of two types.

a) **Clinical Infection:** If the infection is heavy then the symptoms of disease develop and along with recovery from infection, the person also develops a high degree of immunity. In cases of Diphtheria and Small pox, the immunity once developed protects the individual for the entire life while in cases of Pneumonia, Gonorrhoea and Influenza, this immunity is short lived.

b) **Sub Clinical Infection:** If the number of micro-organisms, infecting a person: is small or less virulent then symptoms of disease do not develop but the body develops the immunity. It is a well known fact the children staying under unhygienic conditions develop immunity against many disease due to frequent sub clinical infections.

ii) **Artificial Active Acquired Immunity:** The immunity developed in an individual, after administration of Vaccine (Antigen) is called Artificial Active Acquired Immunity. The various common diseases against which the artificial active immunity can be acquired are- Cholera, Diphtheria, Hepatitis, Measles, Pertusis, Polio, Small pox, Tetanus, Typhoid, Tuberculosis and Yellow fever.

PASSIVE ACQUIRED IMMUNITY

This type of immunity develops upon introduction of Anti-bodies. These anti-bodies are developed in the body of some other individual. Even this can be Natural and Artificial types-

i) **Natural Passive Acquired Immunity:** the anti bodies present in the body of mother get transferred to the fetus through placenta. Due to this the infant remains immune to various diseases like Chicken pox, Diphtheria and Tetanus for about six months.

ii) **Artificial Passive Acquired Immunity:** In this type of immunity, the person is made immune to various diseases by introduction of antibodies. These antibodies are produced in the body of horse or sheep. This type of immunity can easily be developed against Diphtheria, Gas-gangrene, Rabies, Snake bites and Tetanus.

IMMUNISATION

Immunisation means the process of making a person resistant (Non susceptible) to an infection usually by administering VACCINES

Vaccines stimulate the immune system of the body to develop specific antibodies (Active immunisation) which provide the power to fight an infection, if it occurs in routine or natural way. Immune system also has the IMMUNOLOGICAL MEMORY hence produces immediate response during subsequent infection to curb the disease from advancing.

In **Passive Immunisation, antibodies are administered hence immunity is short lived.**

IMMUNOLOGICAL PRODUCTS

The agents used for Immunisation (or to induce Immunity) are termed IMMUNOLOGICAL PRODUCTS. These are always biological products and may be used for inducing Active Immunity or Passive Immunit

Biological products used for Active Immunity are VACCINES and TOXOIDS.

Biological products used for Passive Immunity are ANTI-SERA and IMMUNOGLOBIN

VACCINES

Vaccines are pharmaceutical preparations; of immunogenic substance meant for inducing

ARTIFICIAL ACTIVE ACQUIRED IMMUNITY. Vaccines contain the causative agent in live attenuated or killed state. These may even have Toxoid, Cellular fraction . Some vaccines are Combination vaccine and also Polyvalent vaccines.

Live attenuated vaccine induces immunity, which lasts life time. These may cause if administered to a person having very weak immune system. Examples of live attenuated bacterial vaccine is- BCG (Against TB). Viral vaccines are- Measles, Mumps, Rubella and Polio.

Killed vaccines produce delayed response hence are ineffective if used during incubation period or when disease is in active state. Examples of killed bacterial vaccines are- Cholera, Pertusis, Typhoid and Plague. Examples of killed viral vaccines are- Polio, Rabies, Influenza and Hepatitis-B.

Toxoid vaccines contain the bacterial toxin in attenuated state. These are prepared by detoxifying toxins. Examples are- Diphtheria (DT) and Tetanus toxoids (TT).

Vaccines having cellular fraction are those vaccines which are prepared using the extract of some fraction of cell of causative organism e.g. Meningococcal vaccine is prepared using Polysaccharide antigen present in the cell wall of bacteria. Similarly Pneumococcal vaccine is prepared from the Polysaccharide antigen present in the capsule of the bacteria.

Vaccine combinations are those vaccines which have more than one Immunizing agents and induce immunity against number of diseases. These are cost effective, improve patient's compliance and also reduce number of visits of patient for immunisation e.g. DPT, MMR

Polyvalent vaccines are the vaccines having more than one strain of the same species e.g. Pneumococcal polyvalent vaccine and Poliovirus polyvalent vaccine

IMMUNIGLOBIN

Immunoglobin are also known as ANTIBODIES. These are produced by WBCs. These are Glycoprotein or Globulin. These are very specific in recognising, binding and destroying the infecting bacteria and viruses. These have heavy chain attached to their molecule and are divided into five types depending upon these heavy chain. These are-

ANTIBODY TYPE	**HEAVY CHAIN**
IgG Immunoglobin	G or Gamma (γ) heavy Chain
IgA Immunoglobin	A or Alpha (α) heavy Chain
IgM Immunoglobin	M or Mu (μ) heavy Chain
IgD Immunoglobin	D or Delta (δ) heavy Chain
IgE Immunoglobin	E or Epsilon (ε) heavy Chain

IgG: These are most versatile antibodies and are present up to 75% of total Immunoglobin present in plasma.

IgA: These are present up to 15% of total Immunoglobin. These are present in body secretion and mainly control various local infections.

IgM: These are most effective early defence antibodies and are present in blood and serum. These may be present as Pentamers.

IgD: These are present as Monomers in very low concentration and their role is not very clear; but these have been found to be showing activity against certain antigens like Milk protein, Diphtheria toxoid, Penicillin and Insulin.

IgE: these are present in very low concentration and take part in allergic reactions.

Immunoglobin used as therapeutic agents may be of two types

Human Immunoglobin serum: These originate from human blood e.g. Hepatitis B, Rabies and Tetanus Sera or Antiserum.

Animal Immunoglobin Serum: These are mainly obtained from Equine or horse e.g. Tetanus, Botulinum, Diphtheria, Rabies and Antivenom (Antivenin) sera or Antiserum.

IMMUNISATION SCHEDULE

WHO and UNICEF have adopted an immunisation programme to protect all children of the world from six diseases (Diphtheria, Tetanus, Whooping cough, Polio, Measles and Tuberculosis). This programme is called UNIVERSAL IMMUNISATION PROGRAMME. Now immunisation against Typhoid has also been included. This programme also includes the immunisation of pregnant women against tetanus.

Immunisation schedule under this programme is-

INFANTS

TIME FOR	**IMMUNISATION**
At birth	BCG (Against TB)
06 weeks	DPT and Oral Polio
10 Weeks	DPT and Oral Polio
14 Weeks	DPT and Oral Polio
09 Months	Measles

CHILDREN

16 to 24 months	Booster DPT and Booster Oral Polio
05 to 06 years	DT and Typhoid
10 years	TT and Typhoid
16 years	TT and Typhoid

Pregnant women are given at least one dose of TT during 16 to 36 weeks of Pregnancy. (Who recommends at least 05 doses of TT as these can provide prevention up to 30 years or for total child bearing period of a woman).

ROUTE OF ADMINISTRATION

Polio - Oral

BCG – Intradermal

Measles and Typhoid – Subcutaneous

Polio – Oral

DPT, DT, TT – Intramuscular

PRINCIPLES OF DISEASE CONTROL AND PREVENTION

Each infectious disease has a causative organism. Transmission of this causative organism leads to spread of the disease. If we know the factors responsible for transmission of disease then the transmission of disease can be controlled. Factors responsible for transmission of disease are-

- Reservoir of Infection
- Route of Transmission
- Population at risk

Transmission of infection and hence spread of disease can be controlled at one or all of these of levels.

CONTROLLING TRANSMISSION AT RESERVOIR LEVEL

Reservoir means the person having infection hence liable to spread the same. To control transmission of disease at reservoir level following acts can help-

Early Diagnosis: Early diagnosis always means the remedial measures can be taken well in **time so that the spread remains minimum.**

Notification: Occurrence of infectious disease (Cholera, Malaria Plague and Polio etc.) should be reported by attending physician or head of family, to the health authority so that corrective measures can be initiated immediately.

Isolation: Infected or suspected person is kept in isolation (away from family members and society) till negative report or complete cure of infection.

Treatment: Patient with infection are immediately treated using suitable antibiotics so that the causative organism gets killed and the reservoir and hence chances of transmission ends.

BLOCKING ROUTES OF TRANSMISSION

Transmission always takes a route to spread. Blocking this route contains the transmission. Respiratory infections can be controlled by covering mouth and nose while coughing and sneezing. Similarly the water borne infections (Cholera, Typhoid and gastroenteritis) can be controlled by boiling or purifying water. Similarly the transmission of food borne diseases can be controlled by following principles of hygiene, washing hands regularly and avoiding improperly/under cooked and stale food.

PROTECTING POPULATION AT RISK

Population at risk can be protected by providing the suitable prophylactic protection by use of Immunising agents like Vaccines (Active Immunity) and Sera (Passive Immunity) or Chemoprophylaxis. In chemoprophylaxis the person is administered the medicine(s) which will protect him/her from catching infection. Prophylactic protection is given mainly to those persons who are at high risk of catching infection like persons coming in close contact of infected person(s).

HOSPITAL ACQUIRED INFECTIONS

A **hospital-acquired infection** (**HAI**), also known as a **nosocomial infection**, is an infection that is acquired in a hospital or other health care facility. To emphasize both hospital and nonhospital settings, it is sometimes instead called a **health care–associated infection** (**HCAI**).

This includes the infection other than the condition for which patient was admitted in hospital and includes those infections appearing after 48 hrs of admission and up to 30 days of the discharge. Infections acquired by staff are also included in HAI.

HAI can occur due to interaction of following three

- Presence of infection causing microbes.
- Presence of environment which encourages its multiplication
- Presence of the susceptible host

Following four factors increase the chances and severity of infection

- Low immunity of patient/person
- Repeated contact with infected person
- Presence of Heavily contaminated sites/environment
- Drug resistance of the infecting organism

SOURCES OF HAI

Exogenous: Infection is spread to the susceptible patient by various means like Health care staff, contaminated equipment, bed linens, or air droplets. The infection can originate from the outside environment, another infected patient, staff that may be infected. Usually the source of the infection is difficult to be determined.

Endogenous: In some cases the microorganism originates from the microbes present on the skin of the patient. These microbes become opportunistic after surgery or other procedures that compromise the protective skin barrier. Though the patient may have contracted the infection from their own skin, the infection is still considered HAI OR nosocomial as it develops in the health care setting.

ORGANISMS RESPONSIBLE FOR HAI

- *Staphylococcus aureus*
- Methicillin resistant *Staphylococcus aureus*
- *Candida albicans*
- *Pseudomonas aeruginosa*
- *Acinetobacter baumannii*
- *Stenotrophomonas maltophilia*
- *Clostridium difficile*
- *Escherichia coli*
- Tuberculosis
- *Enterococcus*

TRANSMISSION OF HAI

Contact transmission: It is most important and frequent mode of transmission of nosocomial infections. Contact transmission is divided into two subgroups: direct-contact transmission and indirect-contact transmission.

Direct-contact transmission: This involves a direct body surface-to-body surface contact and physical transfer of microorganisms between a susceptible host and an infected person, such as when a person turns a patient, gives a patient a bath, or performs other patient-care activities that require direct personal contact. Direct-contact transmission can also occur between two patients, with one serving as the source of the infectious microorganisms and the other as a susceptible host.

Indirect-contact transmission: This involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, such as contaminated instruments, needles, or dressings, or contaminated gloves that are not changed between patients. In addition, the improper use of saline flush syringes, vials, and bags can transmit infections

Droplet transmission: This type of Transmission occurs by generated from the infected person mainly by coughing, sneezing, and talking, and during the performance of certain procedures, such as bronchoscopy. These droplets are propelled up to the susceptible host.

Airborne transmission: Very fine droplets and evaporated droplets containing microorganisms can remain suspended in the air for long periods of time or dust particles containing the infectious agent. Microorganisms carried in this manner can be dispersed widely by air currents and may become inhaled by a susceptible host within the same room or over a longer distance from the source patient,

Common vehicle transmission: This applies to microorganisms transmitted to the host by contaminated items, such as food, water, medications, devices, and equipment.

Vector borne transmission: This occurs when vectors such as mosquitoes, flies, rats, and other vermin transmit microorganisms.

PREVENTION AND CONTROL OF HAI

Controlling HAI means implementing the Quality Assurance or Quality Control measures to the health care sectors.

Hospitals have sanitation protocols regarding uniforms, equipment sterilization, washing, and other preventive measures. Thorough hand washing and/or use of alcohol rubs by all medical personnel before and after each patient contact is one of the most effective ways to control HAI.

Despite sanitation protocol, patients cannot be entirely isolated from infectious agents. Following methods are adopted to control HAI

Sterilization

Sterilization goes further than just sanitizing. It kills all microorganisms on equipment and surfaces through exposure to chemicals, ionizing radiation, dry heat, or steam under pressure.

Isolation

To prevent transmission of HAI Isolation is implemented for example isolation of infectious cases in special hospitals and isolation of patient with infected wounds in special rooms also isolation of joint transplantation patients on specific rooms.

Hand washing

Hand washing frequently is called the single most important measure to reduce the risks of transmitting skin microorganisms from one person to another or from one site to another on the same patient. Washing hands as promptly and thoroughly as possible between patient contacts and after contact with blood, body fluids, secretions, excretions, and equipment or articles contaminated by them is an important component of infection control and isolation precautions. Wearing of ring is not advisable.

Gloves

In addition to hand washing, gloves play an important role in reducing the risks of transmission of microorganisms. Gloves are worn for three important reasons in hospitals. First, they are worn to provide a protective barrier for personnel, preventing large scale contamination of the hands when touching blood, body fluids, secretions, excretions, mucous membranes, and non-intact skin

Wearing gloves does not replace the need for hand washing due to the possibility of contamination when gloves are replaced, or by damage to the glove.

Surface sanitation

Sanitizing surfaces is part of nosocomial infection in health care environments. Modern sanitizing methods such as Non-flammable Alcohol Vapour in Carbon Dioxide systems have been effective against gastroenteritis, MRSA, and influenza agents. Use of hydrogen peroxide vapour has been clinically proven to reduce infection rates and risk of acquisition. Hydrogen peroxide is effective against endospore-forming bacteria, such as *Clostridium difficile*, where alcohol has been shown to be ineffective. Ultraviolet cleaning devices may also be used to disinfect the rooms of patients infected with *Clostridium difficile* or MRSA after discharge.

Antimicrobial surfaces

Micro-organisms are known to survive on inanimate 'touch' surfaces for extended periods of time.[28] This can be especially troublesome in hospital environments where patients with immuno-deficiencies are at enhanced risk for contracting nosocomial infections.

Touch surfaces commonly found in hospital rooms, such as bed rails, call buttons, touch plates, chairs, door handles, light switches, grab rails, intravenous poles, dispensers (alcohol gel, paper towel, soap), dressing trolleys, and counter and table tops are known to be contaminated.

A number of compounds can decrease the risk of bacteria growing on surfaces including: copper, silver, and germicides.

DISINFECTION

Definition: A process that eliminates many or all pathogenic microorganisms on inanimate objects, with the exception of bacterial spores.

Disinfectant: Agents used for disinfection are called Disinfectants.

OBJECTIVES OF DISINFECTION

- To get rid of unwanted microorganisms, which MAY be pathogenic
- To minimise the risk of HAI: It is achieved by disinfecting Medical waste, clean- up of the Spill and routine surface decontamination.

Disinfection differs from Sanitization which reduces the numbers of vegetative bacteria only

while Sterilization is the act or process, physical or chemical, that destroys or eliminates all forms of life, including bacterial spores. Related process is cleaning which means removal of visible soil (organic and inorganic) from objects and surfaces by Manual or mechanical methods by use of water with detergents or enzymatic products.

TYPES OF DISINFECTIONS

Depending upon the time at which disinfection is carried, it can be of three types

Concurrent disinfection: This means that micro-organisms are immediately destroyed up on their release from body e.g. disinfection of Urine, Faeces, Sputum, Dressing, Cloth, Linen Apron and Gloves.

Terminal Disinfection: it means the disinfection when patient has been cured and discharged or shifted to other ward or hospital or passed away.

Prophylactic Disinfection: It means preventive disinfection so that infection can be avoided e.g. Chlorination of water, Hand washing using soap and disinfection of floor, walls and other surfaces.

CLASSIFICATION OF DISINFECTANTS

Disinfectants are classified based up on Physical State, Spectrum of activity and the Mechanism of action

Based up on Physical State

Liquid Disinfectants: Alcohol, Isopropyl Alcohol, Phenols

Gaseous Disinfectants: Formaldehyde vapours, Ethylene oxide

Based Up on Spectrum of activity

High Spectrum: These have activity almost comparable to sterilization and are used to disinfect those plastic structure which cannot withstand heat of sterilization e.g. Hydrogen peroxide and Chlorine compounds.

Intermediate Spectrum: These disinfectants cannot kill bacterial spores hence are used for those instruments which do not invade tissues e.g. alcohols and certain phenols.

Low Spectrum: These are mainly used for those instruments with stay on the skin like electrodes, stethoscope etc. e.g. Quaternary Ammonium compounds.

Based upon Mechanism of action

Disinfectants **Attacking Plasma membrane** - Alcohol, Detergents

Disinfectants leading to **denaturation of cellular proteins** – Alcohols, Phenols

Disinfectants causing **oxidation of enzymes** – Hydrogen Peroxide, Halogens

Disinfectants **damaging nucleic acids** – Formaldehyde

DISINFECTANTS USED

- Chlorine bleach,
- Iodine (Betadine)
- Alcohol (Ethyl Alcohol, Isopropyl Alcohol)
- Phenolics (Lysol)
- Quaternary Ammonium Compounds

FACTORS INFLUENCING EFFICACY OF DISINFECTANTS

- Surface topography (Rough or smooth)
- Temperature (Higher temperature is preferred)
- Relative humidity (Higher humidity increases efficacy)
- Water hardness (Hardness reduces efficacy)
- Organic load (Higher load reduces efficacy)
- Concentration (Higher concentration is more effective)
- Contact time (Prolonged contact time is more effective)

DISINFECTION PROCEDURES

FOR URINE AND FAECES

These are collected in a non-porous container and immediately covered with solution of disinfectant (5% Bleaching powder, 5% Phenol, 10% Formalin or Cresol). These may be mixed with10 to 20% suspension of lime and left for two hours. It is them emptied in sewer or buried under soil.

FOR SPUTUM

Sputum may be collected in tissue paper of a piece of gauge and the incinerated. If quantity is more then it is collected in a cup half filled with 5% cresol, left for an hour and then emptied in water closet.

FOR ROOM

All surfaces are properly cleaned using detergent and hot water. These are then sprayed with or mopped with chemical disinfectants like Cresol, Formalin or Bleaching powder. These chemicals are cleaned after about four hours.

Room may even be disinfected using fumigation by Formaldehyde gas.

FOR LINEN AND CLOTH

Linen (Bed sheet, Pillow cover) and cloth like apron and masks can easily be sterilized by Autoclaving (Moist heat sterilization; 122^0C for 15 minutes). This temperature can be achieved at 15lbs/inch pressure. This temperature and time kills even microbial spores.

INSTRUMENTS

Small instruments like surgical instruments can be sterilized by autoclaving or hot air oven. Some are cleaned using detergent or enzyme based cleaning agents and then disinfected using chemical disinfectants like Formalin, Hexachlorophenes and Iodophores. Various instruments may even be disinfected using ionising radiations.

DEAD BODIES

Dead bodies are disinfected using chemical disinfectants and then cremated or buried at the earliest. If required for legal of medical purpose then these are preserved in solution of Formalin.