

MICROBIOLOGY

Rita Carey-Nita R.N., B.S.N.

Microbiology

- Microbiology is the study of microorganism
- Disease is a failure of the body to function normally.
- Many types of disease not all caused by microorganism.
 - Can be:
 - Birth defects—Age related degenerative diseases
 - Tumors—Disease related to trauma, nutritional deficiencies, and environmental toxins

Pathogen

- A pathogen is a disease producing organism
- When it invades the body, normal structure and function is disrupted
- The result in disease.
- Infection is the development of symptoms as a result of the invasion of a pathogen

Types of infection

- Localized infection: restricted to a small area
- Systemic infection: more widespread
- Bacteremia/Septicemia: bacteria in blood spreading throughout the body
- Acute: begins abruptly and severe
- Chronic: slow progression and last longer
- Nosocomial: acquired in health care facility

Microbiology

- Key Terms:
 - Epidemiology: study of the occurrence & distribution of disease in a population
 - Incubation period: time from exposure till symptoms manifest
 - Communicable disease: disease that can be spread from host to host
 - Contagious disease: disease that is easily spread

Key Terms

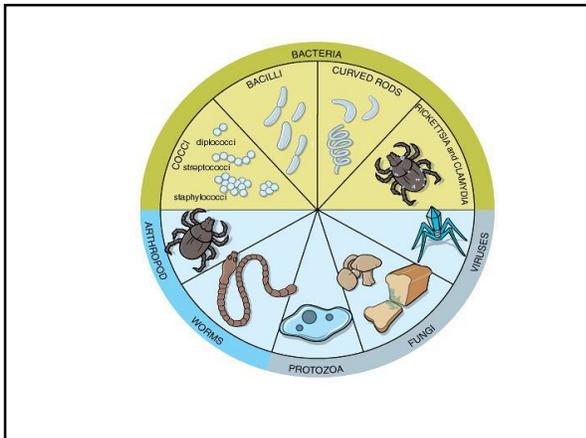
- Epidemic: disease acquired by many people in a given area.
- Endemic: disease that is always present in a population.
- Pandemic: worldwide epidemic.
- Antibiotics: chemicals used to treat bacterial infections. (broad/narrow spectrum)

Key Terms

- Normal flora: are microorganisms on/in body that do not cause disease
- Resistance: ability to ward off disease
- Susceptibility: inability to ward off disease
- Sterilization: process that kills microorganisms
- Vector: Carrier of pathogen from host to host. ie living deer tick-lyme disease

Types of Microorganisms

- Not all microorganisms are pathogens
- Microorganisms include:
 - bacteria
 - viruses
 - fungi
 - protozoa
 - anthropods
 - worms



Bacteria

- Bacteria: single cell organism found everywhere:
 - Can be normal flora; lives in & on the human body; prevents the overgrowth of other organisms, keeping control
 - Can synthesize vitamins, ie vitamin K
 - Can cause disease-enters & grows in human cells/ secrete a toxin that damages cells

Bacteria

- Classified into three groups based on shape:
 - Coccus: round
 - Bacillus: rod
 - Curved rods
- Rickettsiae and Chlamydiae are also classified as bacteria but differ from cocci, bacilli, curved rods

Bacteria

- Cocci are arranged in patterns:
 - Diplococcus: pairs
 - Streptococcus: chains
 - Staphylococcus: clusters
- Disease associated with cocci include:
 - Gonorrhea
 - Meningitis
 - pneumonia

Bacteria

- Bacilli are long and slender and shaped like a cigar
- Diseases caused by bacilli include:
 - Tetanus
 - Tuberculosis
 - Diphtheria

Bacteria

- Curved Rods include:
 - Vibrio: comma shaped
 - Spirillum: corkscrew
 - Spirochete: highly coiled
- Disease produced:
 - Vibrio: cholera
 - Spirochete: Treponema pallidum, causes Syphilis

Bacteria

- Important characteristics of Bacteria:
 - Aerobic bacteria: reproduce in the presence of oxygen
 - Anaerobic bacteria: reproduce in the absence of oxygen
 - They have cell walls to protect them
 - Form spores allowing the bacteria to lie dormant & are difficult to eliminate i.e. Botulism
 - Can produce harmful chemical (toxins)

Bacteria

- Parasitic Bacteria
 - Smaller than most bacteria & need to reproduce in a living host (parasites)
 - Chlamydia: Chlamydia Trachomatis is the most common STD
 - Rickettsia: Rocky Mountain spotted fever carried by a tick
the rickettsiae can be carried by flies, ticks & body lice

Virus

- Viruses
 - ***Smallest infectious agent & are not cells***
 - DNA or RNA surrounded by protein shell
 - Reproduce only in living cells of a host so considered parasites
 - Difficult to treat due to closeness of virus and host cell
 - Do not respond to antibiotics

Virus

- Disease produced by viruses:
 - Mumps
 - Measles
 - Polio
 - Influenza
 - AIDS

Fungus

- Fungus is a plantlike organism that grows best in dark, damp places
- Types: Yeast & Mold
- Pathogenic fungi cause mycotic infections: i.e. Athlete's foot, ring worm, thrush, vaginitis (overgrowth of candida albicans)
- Systemic infection is rare but difficult to treat

Protozoa

- Protozoa: single cell, animal like microbes.
- Four main types:
 - Amebas
 - Ciliates
 - Flagellates
 - Sporozoa

Protozoa

- Protozoa are found in water & soil
- Diseases include:
 - Amebic dysentery & Giardiasis: parasites ingested in contaminated food & water
 - Malaria: sporozoon called plasmodium malariae carried by mosquito
 - Pneumocystis carinii causes pneumonia
 - Cryptosporidium causes diarrhea

Worms & Parasites

- Multicellular Organisms:
 - Parasitic worms
 - Arthropods
- Parasitic Worms called helminths
 - Parasitic & Pathogenic to humans
 - Require stool specimen to diagnose most worm infestations

Worms

- Two types of worms:
 - Roundworms & Flatworms
- Roundworms include:
 - Ascarides
 - Pinworms
 - Hookworms
 - Trichinea
 - Filariasis

Worms

- Pinworms are the most common and transferred by fecal oral route
- Trichinosis is transmitted by ingestion of uncooked pork
- Filariasis is transmitted by biting insect

Worms

- Flatworms include:
 - Tapeworms and Flukes
- Tapeworms live in intestine & may grow 5 – 50 feet long
- Flukes are flat, leaf-shaped that invade blood, liver, lungs & intestines.
- Feed off host causing weight loss & anemia
- Treat with anti-helminths

Anthropods

- Arthropods are animals with jointed legs.
 - Tics and Insects.
- Ectoparasites: live on the surface of the body, skin & mucous membranes.
- Not life threatening but cause itch & discomfort

Anthropods

- Arthropods that are more serious include: mosquitoes, biting flies, fleas & ticks because they act as vectors of disease.
- A bite from an arthropod introduces a pathogen into the host causing infection
 - Mosquito: malaria
 - Tick:
 - Lyme disease
 - Rocky Mountain spotted fever

Identification of Pathogens

- Bacteria are classified by **Gram Staining**
 - A gram-positive bacterium is purple or blue
 - Streptococcus is gram-positive
 - A gram-negative bacterium is pink or red, does not pick up the purple stain
 - Escherichia coli is gram negative
 - Gram staining is the first step in identification of the organism

Identification of Pathogens

- **Acid Fast** is another staining
- The bacterium is first stained with a red dye then washed with an acid.
- Most bacteria loss the red stain.
- Those that retain the red stain are referred to as acid-fast.
- Most common acid fast bacteria is Mycobactrium tuberculosis

Culture & Sensitivity

- To identify a pathogen growing in a wound a wound **culture** is ordered.
- A sample of the wound is taken and placed on culture medium that supports the growth of the pathogen.
- It is then stained and identified.
- **Culture- identifies the organism**

Culture & Sensitivity

- A **culture & sensitivity** may be ordered as well to determine pathogens susceptibility to antibiotics.
- If the antibiotic placed on the culture stops the growth of the pathogen it is said to be sensitive to the effects of the antibiotic.
- That is the antibiotic the physician order to treat the patient's infection
- **Sensitivity- determines the drug of choice**

Spread of Infection

- Pathogens enter the body by **portals of entry**: respiratory tract, GI tract, GU tracts, skin, eyes, mucous membrane, bites, cuts and surgery
- Entry is how the pathogen enters the body
- Respiratory & GI tract most common entry
- Break in skin is another excellent source

Spread of Infection

- **Portal of Exit** is how a pathogen leaves an infected body.
 - Include: Respiratory tract, GI tract, GU tract, blood, bodily fluids, skin, eyes (tears), breasts (milk)
 - Most common portal of exit is respiratory and GI tract
- Example: Common cold virus spreads with sneezing or cough

Spread of Infection

- Knowing the portal of exit of a pathogen can assist in preventing the spread of the pathogen.
- Example: Salmonella typhi is excreted in stool so caution is taken when handling underwear or bed linens.

Spread of Infection

- How pathogens spread:
 - Person to person-
 - Droplet: sneeze then inhaled
 - Vector: from hand to hand, hand to phone then phone to hand
 - Fomite: non-living; hankies, doorknobs, syringe
 - Environmental to person- water, air, soil, food
 - Eat contaminated food
 - Drink contaminated water
 - Walking in contaminated soil

Spread of Infection

- Tiny animal to person
 - Insects
 - Mosquito bites a person with malaria
 - Then malaria causing plasmodium matures in the mosquito's stomach
 - The mosquito then bites another person and spreads the malaria
 - This is example of a **Biological Vector**
 - Need the mosquito to mature the plasmodium
 - **Mechanical Vector** simply spreads the pathogen

Spread of Infection

- Germ Stories
 - Wash those Mittens
 - Nosocomial
 - Flora and her Vaginal Itch
 - Opportunistic infection
 - Rick, Nick, and the Sick Tick
 - Tick as reservoir of infection, spread by bite
 - Communicable disease
 - Typhoid Mary
 - Salmonella typhi spread from contaminated hands

Spread of infection

