Unit Four - Safe and Sound

Principles of Infection - Lecture Notes

Principles of Infection

• Understanding the basic principles of infection is essential for any health care worker in any field of health care.
  · Disease transmission
  · Prevention of disease transmission

Nature of Microorganisms

• Microorganisms (microbes) are small, living organisms that are not visible to the naked eye.
• Pathogens (germs) are microorganisms that cause disease.
• Non-pathogens are microorganisms that do not cause disease; can be beneficial.
• At times, a microorganism that is beneficial in one body system can become pathogenic when it is present in another body system.
  · Escherichia coli (E. coli) bacteria:
    · Large intestine: beneficial, part of the natural flora.
    · Urinary system: causes an infection.

Non-Pathogens

• Some microorganisms can be beneficial in other kinds of environments:
  · Support the production of bread, cheese, yogurt, beer, and several other foods and beverages.
  · Contribute to the health of soil for farming.
  · Aid in purifying water.

Types of Microorganisms

• Bacteria
  · Simple, one-celled microorganisms that are classified according to their shape and arrangement.
  · Cause diseases such as strep throat, pneumonia, meningitis and tuberculosis.
  · Antibiotics are used to kill bacteria – however some strains have become resistant.
  · Less than 1% of bacteria are harmful.
  · There are more bacteria in our mouths than humans living on the planet.
  · Types:
    • Streptococci (chains)
    • Staphylococci (clusters)
    • Diplococci (pairs)
    • Micrococci (tiny)
    • Flagellated forms (tails)
    • Bacilli (rod-shaped)
    • Vibrios
    • Spirilla (spiral)
    • Spirochetes (comma)

- Fungi
  - · A plantlike organism that lives on dead organic matter.
  - · Yeasts and molds can be pathogenic.
  - · Cause conditions such as ringworm, athlete's foot, yeast infections, and thrush.
  - · Antibiotics do not kill fungi. Antifungal medications are available, but expensive and may cause liver damage.
- Protozoa
  - · One-celled animal like organisms often found in decayed materials and contaminated water.
  - · Many contain flagella which allow them to move freely.
  - · Cause diseases such as malaria, trichomonas, and amebic dysentery.
- Rickettsiae
  - · Parasites that live inside the cells of other living organisms.
  - · Commonly found in fleas, lice, ticks, and mites and are transmitted to humans by the bites of these insects.
  - · Cause diseases such as Rocky Mountain spotted fever and typhus fever.
  - · Antibiotics are effective against many different rickettsiae.
- Viruses
  - · Smallest of all microorganisms – visible only using an electron microscope.
  - · Cannot reproduce unless they are inside another living cell.
  - · Spread by contact with blood and other body fluids.
  - · Difficult to destroy. Not affected by antibiotics.
  - · Associated with diseases such as the common cold, chicken pox, herpes, hepatitis B, measles, warts, polio, influenza, and AIDS.
  - · Three viruses are of major concern to the health care worker:
    - · Hepatitis B – leads to destruction and scarring of liver cells. Vaccine is available.
    - · Hepatitis C – also causes serious liver damage. No vaccine. Often misdiagnosed as the flu.
    - · AIDS/HIV – suppresses the immune system. No cure and no vaccine.

Factors That Influence Microbial Growth

- Following factors influence microbial growth:
  - · Temperature
  - · pH, or the values used in chemistry to express the degrees of acidity or alkalinity of a substance
  - · Darkness
  - · Food
  - · Moisture
  - · Oxygen
- Aerobic microbes – live only in the presence of oxygen.
- Anaerobic microbes – grow best in the absence of oxygen.

Causing an Infection

• Pathogenic microorganisms cause infection and disease in different ways.
  · Produce poisons (toxins) which harm the body. Ex: Tetanus.
  · Allergic reaction in the body causing runny nose, watery eyes, sneezing.
  · Attack and destroy the living cells they invade. Ex: Malaria (rbc's).
• Endogenous – disease originates within the body. Ex: metabolic disorders, congenital abnormalities, tumors.
• Exogenous – disease originates outside the body. Ex: chemical agents, electrical shock, trauma.
• Nosocomial – acquired by an individual in a health care facility (workers to patient).
  · Many are antibiotic resistant, life-threatening.
• Opportunistic – occur when the body's defenses are weak. Ex: pneumonia w/AIDs.
• In order for disease to occur and spread from one individual to another, certain conditions must be met.
• If any one condition is not met, the transmission of the disease will not happen.
• Pathogens are everywhere and preventing their transmission is a continuous process.

Chain of Infection

• Chain of infection contains six elements. If broken, infection will not occur.
• Infectious Agent – pathogen such as a bacteria or virus.
• Reservoir – a place the pathogen can live.
  · Examples: human body, animals, the environment, fomites.
  · Fomites are objects contaminated with infectious material that contains pathogens.
    · Ex: doorknobs, bedpans, linens, instruments.
• Portal of Exit – way to escape from the reservoir in which it has been growing.
  · Urine
  · Feces
  · Saliva
  · Respiratory tract
  · Skin
  · Blood
  · Gastrointestinal tract
  · Mucous discharge
  · Tears
• Mode of Transmission – way in which it can be transmitted to another reservoir or host where it can live.
  · Can be through direct contact or airborne droplet.
  · Contaminated hands are one of the most common sources of direct transmissions.
    · Hand washing is one of the most effective means of preventing the spread of pathogens.
• Portal of Entry – way to enter the new reservoir or host.
  · Respiratory tract, mucous membranes, and gastrointestinal tract are common.
  · Damaged skin.

• Susceptible Host – one that is capable of being infected.
  · Microorganisms must be present in large enough quantity to be virulent.
  · The host must be susceptible.
  · Individuals with an immunity to certain pathogens will not be susceptible.

Body Defenses

• If defense mechanisms are intact and the immune system is functioning, a human can frequently fight off the causative agent and not contract the disease.
  · Mucous membranes (traps pathogens)
  · Cilia (propel pathogens out of respiratory tract)
  · Coughing and sneezing
  · Hydrochloric acid (stomach)
  · Tears in the eyes (contain bacteriocidal chemicals)
  · Fever
  · Inflammation (wbc's destroy pathogens)
  · Immune response (produce antibodies)

Signs & Symptoms of Infection

• Redness
• Swelling
• Tenderness
• Warmth
• Drainage
• Red streaks leading away from wound