

# Unit Four - Safe and Sound

## Principles of Infection - Lecture Guide

Name \_\_\_\_\_ Date \_\_\_\_\_

### 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.

### Nature of Microorganisms

■ 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.

### Types of Microorganisms

#### ■ Bacteria, cont. . . .

– 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.

■ Streptococci (chains)

■ Staphylococci (clusters)

■ Diplococci (pairs)

■ Micrococci (tiny)

■ Flagellated forms (tails)

■ Bacilli (rod-shaped)

■ Vibrios

■ Spirilla (spiral)

■ Spirochetes (comma)

### Types of Microorganisms

#### ■ 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.

## **Types of Microorganisms**

### ■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.

## **Types of Microorganisms**

### ■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.

## **Types of Microorganisms**

### ■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.

## **Viruses**

- 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

## **Factors That Influence Microbial Growth**

■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).

## **Causing an Infection**

■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.

### **Causing an Infection**

■ 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.

### **Chain of Infection**

■ 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.

### **Chain of Infection**

■ 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

### **Chain of Infection**

■ 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.

### **Chain of Infection**

■ Portal of Entry – way to enter the new reservoir or host.

– Respiratory tract, mucous membranes, and gastrointestinal tract are common.

– Damaged skin.

### **Chain of Infection**

■ 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