Chapter 16

Infection Control

Objectives

1. Define the terminology related to infection control.
2. Categorize the four basic infectious agents, along with their unique characteristics.
3. Explain the steps involved in the establishment of an infectious disease.
4. Discuss the four factors involved in the spread of disease and the chain of infection.
5. Describe the various sources of nosocomial infection.
6. Explain the constituents of microbial control within the host.
7. Contrast medical and surgical asepsis.
8. List the chemical and physical methods of asepsis.
9. Demonstrate the medically aseptic hand-washing technique.
10. Describe the basic premises of standard precautions.
11. Relate types of transmission-based precautions with appropriate clinical situations.
12. Demonstrate the contact precautions technique.
Disease

• Any deviation from or interruption of the normal structure or function of any part, organ, or system (or combination thereof) of the body
• Caused by microbes
• Absence of health
• Health care practitioner must have an understanding of what infectious diseases are, how they are spread, and how they are controlled

Infection

• Establishment and growth of a microorganism on or in a host, resulting in injury to the host
• Caused by pathogenic organisms
• Pathogens have three functions
  • Exotoxins

Colonized or Infected: What Is the Difference?

• People who carry bacteria without evidence of infection (fever, increased white blood cell count) are colonized.
• If an infection develops, it is usually from bacteria that colonize patients.
• Bacteria that colonize patients can be transmitted from one patient to another by the hands of health care workers.
Types of Pathogens

- Bacteria
- Viruses
- Fungi
- Parasitic protozoa

Bacteria

- Microscopic, single-celled organisms
- Prokaryotes—lack nuclei and membrane-bound organelles
- Reside in host as a group or cluster called a colony
- Classified as cocci or spheres, bacilli or rods, and spirals
- Gram staining—staining technique to classify bacteria

Bacteria

- Contains both DNA and RNA
- Produces endospores:
  - Internal
  - Metabolically dormant and highly resistant to external environment
Viruses

- Microscopic, single cell
- Cannot live outside a living cell—lack components for own survival
- Carry their own DNA or RNA but never both
- Viral particle (virion) attaches to host cell, inserts its own genetic information, then redirects host cell to produce new viruses
- Not affected by antibiotics

Virus

- Size of a virus may vary from 20 to 250 nm.
- Direct observation of a virus is possible only through an electron microscope.
- May lie dormant for extended periods of time and then manifest in illness.

Fungi

- Eukaryotic (has nucleus and membrane-bound organelles)
- Size much larger than bacteria
- Medically important fungi are called dimorphic
- Two forms: yeast and molds
Parasitic Protozoa

- Organisms are neither plant nor animal
- Larger than bacteria
- Classified by their motility
- Live on or in other organisms at expense of host
- Usually have motile functionality
- Can ingest food particles, and some are equipped with digestive systems

Establishment of Infectious Disease

1. Encounter
2. Entry
3. Spread
4. Multiplication
5. Damage
6. Outcome

Encounter

- Involves the infectious organism coming in contact with the host
- Each encounter varies according to the host and microorganism
Entry
• Access to the organism thru a portal of entry
• Entry may be one of two types

Spread
• The propagation of the infectious organism
• Requires overcoming of body's immune defenses
• Degree of spreading is a function of the logistics of both the host and the microbe

Multiplication
• The growth in microbe numbers as a function of mitosis
• Many infectious agents undergo great multiplication before their impact is recognized by the host
Damage

- Damage can be either direct or indirect
- A microbe can induce a host response that also causes tissue and cell death through activation of the host's inflammatory and immune responses

Outcome

- Results in any of three outcomes
  - Host gains control of the infectious agent and eliminates it
  - Infectious agent overcomes host's immunities to cause disease
  - Host and infectious agent compromise and live in a sort of symbiotic state

Routes for Disease Transmission

- Air
- Droplet
- Contact
- Transmission may be exogenous or endogenous
Community-Acquired Infection

Infection acquired by a person before he or she enters a health care facility

Factors That Encourage Nosocomial Infections

• Environment
• Therapeutic regimen
• Equipment
• Contamination during medical procedures

Factors Increasing Potential for Nosocomial Infections

• Age
• Heredity
• Nutritional status
• Stress
• Inadequate rest or exercise
• Personal choice habits
• Health history
• Inadequate defenses
Blood-Borne Pathogens

- HIV
- HBV

Blood-Borne Pathogens

- Disease-causing microorganisms present in human blood
- Considered nosocomial
- Two types are of concern in hospital setting:
  - HIV (human immunodeficiency virus)
  - HBV (hepatitis B virus)

HIV

- Virus specifically infects immune system in host
- Responsible for acquired immunodeficiency syndrome (AIDS)
- Symptoms: weight loss, muscle and joint pain, glandular pain and swelling, night sweats
- May be asymptomatic after exposure to HIV for as long as 10 years
- May take up to 1 year for results of blood test to become positive for HIV antibodies
HBV

- Primarily affects liver, resulting in swelling, soreness, and loss of normal function of liver
- Symptoms: weakness, fatigue, anorexia, nausea, abdominal pain, fever, and headache
- Leads to yellow skin color (jaundice)
- Some patients are asymptomatic
- Blood will test positive 2 to 6 weeks after symptoms develop
- Can recover in 6 to 8 weeks, but blood test will always show they were exposed

Defense Mechanisms of the Body

**Internal Mechanisms**
- Mechanical Barriers
- Chemical Processes
- Cellular Processes

**External Mechanisms**
- Normal Microbial Flora
- Physical Methods
  - Hand washing
- Chemotherapeutic Agents
  - Bactericidal
  - Bacteriostatic
- Immunizations
  - Vaccines

Standard Precautions

- Incorporate the features of both body fluid precautions and body substance isolation
- Should be used when performing procedures that may require contact with blood, body fluids, secretions, excretions, mucous membranes, and nonintact skin
- Practice **biosafety** in medical imaging
Transmission-Based Precautions

- Airborne Precautions
- Droplet Precautions
- Contact Precautions

Medical Asepsis
Surgical Asepsis
Disinfectant
Sterilization

Contact Precautions

**FIG 16-8D**, Put on nonsterile gloves.
**FIG 16-8G**, Remove the protective bag, never touching the inside, while an assistant removes the cassette without touching the outside of the bag.
Hand Washing

Because a radiologic technologist comes in contact with myriad patients on a daily basis, hand washing absolutely must be performed before and after each patient is attended to. This practice provides the simplest method of environmental control.

Alcohol-Based Hand Rubs

- Require less time
- Convenient
- More effective for standard hand washing than soap
- More accessible than sinks
- Reduce bacterial counts on hands
- Improve skin condition

Conclusion

- Infection involves the establishment and dissemination of a microorganism on or in a host.
- Infectious diseases are caused by pathogenic microorganisms
- Nosocomial infections are those acquired in the hospital setting.
- The human body has mechanical, cellular, and chemical mechanisms that it uses to fight infection.
- Through aseptic techniques, environmental control of infection is simple.
- Medically aseptic hand-washing techniques, standard precautions, and transmission-based precautions have contributed significantly in reducing the probability of spreading infectious diseases.