

Approaches to Infection Control

Considerations for PTAs in the Clinic

Objectives

- Describe the basic characteristics of bacteria, viruses, fungi, and parasites.
- Discuss the locations, advantages, and disadvantages of resident (normal) flora.
- Describe the methods of transmitting microbes.
- List the factors determining host resistance.
- Explain the factors contributing to pathogenicity and virulence of microbes.

Objectives

- Discuss methods of preventing and controlling infection.
- Describe the stages in the development and course of an infection.
- Describe typical, local, and systemic signs of infection.
- Describe the mechanisms of action of common antimicrobial drugs.

Foundations in Infection Control

- Microorganisms – small, living organisms visible under a microscope
- Pathogens – disease-causing microorganisms
 - Bacteria, fungi, viruses, and protozoa,
- Infectious disease – invasion and multiplication of pathogens resulting in disease (tissue or body)
- Asepsis – absence of pathogens

Foundations in Infection Control

- Bacteria
 - Simple unicellular structure, reproduces in a welcome host environment, does not require living tissue to survive (e.g., can be found in soil)
 - Contains an outer, rigid cell wall which can be damaged (thus eliminating reproduction) by antibiotics
 - Can distribute a variety of toxins which impact cellular function in host environments
 - Insufficient nutrients, oxygen, and pH changes can slow or prevent its reproduction

Foundations in Infection Control

- Viruses
 - Requires a living host for replication
 - Invades a host cell and uses the host cell's metabolic pathway to both destroy the cell and reproduce the virus
 - May be latent (lie dormant and replicate slowly or much later)
 - Can subtly mutate, thus making treatment and inoculation challenging
 - Some may alter host cell chromosomes resulting in malignancy (cancer)
 - Virulence = degree of pathogenicity. High virulence equals high infection and mortality rate

Foundations in Infection Control

- Fungi
 - Found everywhere (plants, animals, food, humans)
 - Infection results from proliferation of single cell yeast or molds
 - Pathogenic fungi typically involve infection of the skin or mucous membranes
 - May see normal populations flourish and result in infection during immuno-compromise (e.g, candida "yeast" infection in mouth/tongue)

Foundations in Infection Control

- Protozoa
 - Live independently or as parasites
 - Examples are malaria and amoebic dysentery

Treatment of Infection

Pathogen	Drug and Mechanism of Action
Bacterial	Antibacterial, antibiotic- attacks the cell wall, membrane permeability, or cellular protein synthesis
Virus	Antiviral- decrease reproduction but can not destroy virus
Fungi	Antifungal – interfere with cell division or cell membrane permeability

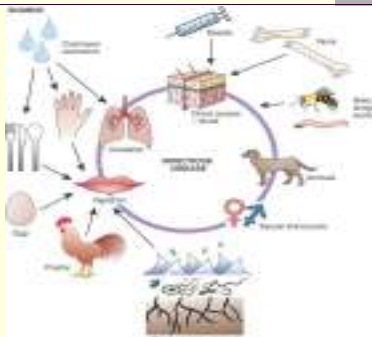
Foundations in Infection Control

- Resident flora
 - Microorganisms (primarily bacteria) that normally exist in many areas of the body (e.g., skin, mouth, nasal cavity)
 - Non-pathogenic when normal balances are maintained
 - Can result in **opportunistic** infection with immuno-compromise or if normal floral balance is disrupted

Foundations in Infection Control

Resident Flora Present	Sterile Area (no flora)
Skin	Blood, cerebral spinal fluid
Nose, pharynx	Lungs
Mouth, colon, rectum	Stomach
Vagina	Uterus, fallopian tubes, ovary
Distal urethra and perineum	Bladder and kidney

Route of Infection



Transmission of Infectious Agents

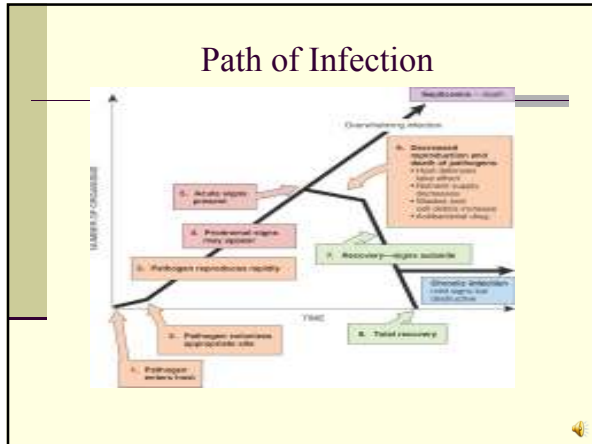
- Source of infection
 - Reservoir – active symptoms of infection are present
 - Carrier – no outward signs/symptoms of infection
 - Contamination – from animal, soil, equipment, water

Transmission of Infectious Agents

- Mode
 - Direct – through touching or fluid exchange (e.g. sexual intercourse); no intermediary
 - Indirect – involves an intermediary (e.g. food, contaminated Kleenex, bed linen)
 - Droplet – when respiratory/salivary secretions are expelled from the body
 - Vector – transmitted by insect or animal (e.g., malaria by mosquitoes)

Transmission of Infectious Agents

- Incubation Period
 - time between entry of the organism into the body and appearance of clinical signs of the disease
 - Incubation periods vary considerably, depending on the characteristics of the organism, and may last days or months.
 - Organisms reproduce until there are sufficient numbers to cause adverse effects in the body.




Adverse outcomes of Infection

- Septicemia
 - Pathogens are circulating and reproducing in the blood

Transmission of Infectious Agents

- Transmission through hands is considered the most prevalent direct and indirect contact methods of infection transmission



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Transmission of Infectious Agents

- Nosocomial infection
 - Infection from health care providers/setting
 - Accounts for at least 10-15% of infections treated in the hospital
 - Spread by direct contact or through use of contaminated objects (indirect)

Factors That Decrease Host Resistance

- Age (infants and the elderly)
- Genetic susceptibility
- Immunodeficiency of any type
- malnutrition
- Chronic disease
- Severe physical or emotional distress
- Inflammation or trauma effecting the skin and/or mucosa (e.g. burns, catheter placement)
- Poor inflammatory response (prolonged use of corticosteroids)

Breaking the Chain of Infection

- Universal Precautions
 - All bodily fluids, blood and wastes are considered infected
 - Gloves and appropriate protective apparel are then used to reduce the transmission of organisms in either direction, that is, from patient to caregiver and from caregiver to patient

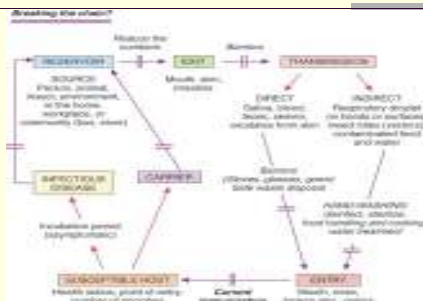
Breaking the Chain of Infection

- Reservoir and sources of infection need to be located and removed
- Refrain from traveling when actively infected
- Monitor through lab testing for persistent signs of infection
- Minimize potential for infection through correct cough/sneeze technique (sleeve, covering nose/mouth)
- Use protection when mode of transmission is known (e.g., condoms, PPE)
- Perform frequent hand washing
- Disinfect and dispose of equipment/supplies using techniques to minimize spread of disease
- Maintain immunizations and ensure booster to maintain adequate host resistance

Breaking the Chain of Infection

- Sterilization
 - Use of heat or burning to destroy microorganisms
- Disinfectants
 - chemical solutions that are known to destroy microorganisms or their toxins on inanimate objects.
- Antiseptics
 - chemicals applied to the skin that do not usually cause tissue damage, such as isopropyl alcohol-70%; generally affects organisms on the surface

Breaking the Chain of Infection



Clinical Signs and Symptoms of Infection

- Erythema (redness)
- Edema (swelling)
- Pain or tenderness
- Warmth/fever
- Specific signs
 - Respiratory tract – cough/sneeze
 - Digestive tract – vomiting/diarrhea
 - Bacterial – exudate (pus), fatigue, weakness, loss of appetite (anorexia), headache, joint pain

Summary

- Infections are caused by pathogenic microorganisms.
- Bacteria are single-cell organisms enclosed within a cell wall and sometimes an outer capsule. They reproduce by binary fission. They may secrete toxins that damage the human host cells.
- A virus is an intracellular parasite requiring a living host cell for reproduction. They cause disease by destroying human cells during replication or by altering human cell DNA.
- Only a few fungi are pathogenic; *Candida* is an example of an opportunistic member of resident flora in the human body.
- Resident or normal flora refers to the large variety of nonpathogenic microbes normally present in diverse sites in the body, such as skin, mouth, nose and pharynx, intestines, and vagina.
- The degree of virulence of a specific pathogen determines the severity of the resulting infection.
- Transmission of pathogens may occur by direct or indirect contact, including oral or respiratory droplet, sexual contact, cross contamination, or vector.
- The infection cycle may be broken by reducing the reservoir of microbes, blocking transmission, or increasing host resistance.

Summary

- Universal precautions, as outlined by the CDC, assume that blood and body fluids from any person may be a source of infection; therefore, appropriate preventative measures must be taken with all individuals.
- Signs of infection are not apparent until sufficient numbers of microorganisms are established and reproducing in the body. Local signs of infection include inflammation and necrosis of tissue. Systemic signs include fever, headache, fatigue, anorexia, and malaise.
- Infection may be eradicated without drug treatment when the microbial colony becomes limited in growth, perhaps because of insufficient nutrients, or when host defenses destroy the invader.
- Antiviral drugs limit viral replication, thus reducing the active stage, but do not kill the virus or cure the source of infection; therefore, appropriate preventative measures must be taken with all individuals.

References

- Gould, Barbara E.. *Pathophysiology for the Health Professions, 3rd Edition*. W.B. Saunders Company
