Microorganisms and Infectious Disorders

- Microorganisms (Germs)
  - They are living plants and animals
  - Microscopic

Microorganisms

- When invaded by a microorganism, one of three things can occur:
  - The body’s immune system eliminates them
  - It lives in the body without causing disease
  - It causes an infection or infectious disease
Microorganisms

- The factors that will influence infection development are:
  - The type of microorganism
  - The microorganisms characteristics
  - And the susceptibility of the host

Types of Microorganisms

- Some organisms cause communicable or contagious Diseases
  - Measles
  - Streptococcal sore throat

Types of Microorganisms

- Some organisms cause communicable or contagious Diseases
  - STD’s
  - Tuberculosis
Types of Microorganisms

- **Bacteria**
- **Single Celled**
  - Round ~ *Cocci*
  - Rod-shaped ~ *Bacilli*
  - Spiral ~ *Spirochetes*

**Types of Microorganisms**

**Bacteria**

- **Aerobic bacteria**
- **Anaerobic bacteria**

**Types of Microorganisms**

- **Drug resistant bacteria**
  - MRSA
  - VRE
  - Acinetobacter
Viruses

• Viruses are the smallest disease causing agents
• They can only be seen with a high powered electron microscope
• They are filterable and can pass through very small barriers

Viruses

Two types of viruses
• Nucleic acid compositions containing
  - RNA
  - DNA

Viruses

• Viruses use metabolic and reproductive materials of living tissue to multiply
• Minor and self-limiting
  - common cold
• Serious and can result in death
  - rabies
  - polio
  - hepatitis
Viruses

- Viruses can be dormant and live in the host until a time when they reactivate and then the infection can recur
  - Herpes Simplex Fever Blister

Richettsiae

- Resemble bacteria but are not the same
- They invade living cells and cannot live outside the host
- Transmitted by fleas, ticks, mites & lice (arthropods)

Protozoan

- Single celled animals, classified according to their motility
  - Amoeboid Motion
  - Cilia
  - Flagella
  - Some have little or no movement
**Mycoplasmas**

- Single celled microorganisms that lack a cell wall
- Resemble bacteria but are not the same
- Consider pleomorphic – assumes many shapes
- Primarily infect the surface lining of the Respiratory, GI, & GU tracts

**Helminths**

**Infectious worms**

- Considered parasites
- Some are microscopic
- 3 Major groups
  - Nematodes ~ round worm
  - Cestodes ~ tape worm
  - Trematodes ~ flukes

**Helminths**

**Infectious worms**

- Some enter host in the egg stage
- Others spend the larval stage in an intermediate host and then enters the human host
- The organisms mate and reproduce in the definitive host and then are excreted and the cycle begins again
Prions

- Protein without nucleic acid
- Normal prions in brain cells protect against dementia
- If it mutates prions are capable of causing an infection
- This will cause other prions to mutate

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Prions

- The mutation can be caused by genetic predisposition
- Or acquired by transmission from an infected animal
- Can be transferred from sheep or cattle, which then can be transmitted to humans
  - Mad Cow Disease

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Characteristics of Microorganisms

- Non Pathogen: not dangerous to healthy human
- Normal Flora: in the intestine they help to synthesize
  - Vitamin B-12, biotin, vitamin K and folic acid
Characteristics of Microorganisms

- Pathogens have a high potential for causing infectious diseases
- The ability to cause disease depends on
  - the organism ability to move or be moved
  - Its virulence

QUESTION???

Is the following statement true or false?

Only pathogenic microbes cause disease or infection.

Pathogens

- The ability to cause disease depends on
  - The number present
  - Duration of exposure
  - Ability to invade the host
  - Susceptibility of the Host
Characteristics of Microorganisms

- If the circumstances are right, BOTH pathogens and non-pathogens can produce an infection.
- Opportunistic disease.
- Most infections are caused by common pathogens.

Infection Transmission

- *Infection process cycle*—resembles a chain and must be present to transmit an infectious disease from a human or animal to a susceptible host.
QUESTION????
Is the following statement true or false?

All links in the infectious process cycle must be present for infection to occur.

Reservoir

Portal of Exit
Means of Transmission

- The way a microorganism is moved out of the reservoir to the susceptible host
- 5 Potential Means
  - Contact
  - Droplet
  - Airborne
  - Vehicle
  - Vector

Portal of Entry

Defense Mechanisms

- Mechanical defenses
- Chemical defenses
Defense Mechanisms

• Skin and Mucous Membranes

• Mucus secretion

Susceptibility of Host

• Immunosuppression
• Diabetes
• Surgery
• Burns
• Elderly

Physiologic Reflexes

• Physiologic Reflexes
Macrophages

- Macrophages
  - Ingest dead cells and foreign material
  - In the liver, spleen and lymphoid tissue

Chemical Defenses

- Biologic Substances
  - Lysozyme

Chemical Defenses

- Antibodies or Immunoglobulins
Chemical Defenses

- Antibodies and other white cells work together to make microorganism more easily ingested by WBCs.

- WBC also produces interferon, which is a chemical protein that causes the infected cells to manufacture an antiviral protein. It is used in cancer treatment.

Pathophysiology

- Localized infection
- Inflammatory Response
Pathophysiology

Generalized Infections

- Microorganisms can reach the blood stream and cause *septicemia or sepsis*.

- The Pathophysiology of this type of infection depends on the
  - Virulence of the pathogen
  - Condition of the host

Generalized Infections

- In the early stages of the disease there may be no symptoms or pt may be acutely ill

- Fever rises as the body attempts to destroy pathogen with heat

- Pt feels chilled - surface blood vessel constrict
Generalized Infections

• Circulation is diverted to deep blood vessels and sweating stops

• The pulse and resp rate rise in proportion to the fever

• Some will have a drop in B/P — septic shock, bacteremic shock, or toxic shock may occur

Diagnostic Test

• Physical Exam

• History

• Lab ~ WBC with Differential
  — ↑ of WBC over 10,000 occurs with infection — Leukocytosis
  — Differential count is valuable in isolating an infection- it gives a % of WBC subtypes
  — ↑ of neutrophils — body’s in early stage of response to infection

• Lab ~ WBC with Differential
  — As WBC’s are depleted, the bone marrow makes new cells — Band Cells - which mature and take the place of old cell
  — An increase in monocytes (the largest sized subtype of WBC’s) is the body’s second line on defense.
Culture and Sensitivity

- Culture – a Specimen to help identify bacteria causing the infection
- A specimen is placed in a special growth medium and incubated for a specific time

Culture and Sensitivity

- The specimen is observed under the microscope
- Dye may be added to the specimen ~ Stained to aid in identification
- Gram Stain – Blue Dye
  - Gram Negative
  - Gram Positive

Culture and Sensitivity

- Microorganisms have also been tested for pathogenicity or virulence with the Coagulase Test
Culture and Sensitivity

- Sensitivity studies
  - studies that are done to determine which antibiotic inhibits the growth of a non viral microorganism

Examination for Ova and Parasites

- Most ova (eggs) and parasites are intestinal worms
- Stool is examined for any forms of the microorganism
  - 3 Random stool samples are collected in a clean, dry bedpan (not the commode)
    - Urine and toilet paper may alter the specimen
- Teach the pt proper hand washing to prevent re-infestation

Skin Test

- Skin Test: to determine to presence of a specific active or inactive infection
- Disease for which skin test are done may include:
  - Mumps, TB, Diphtheria
- The material for testing is injected intradermally
Skin Test

- The test is read in 48-72 hours
- Size of the induration- not the area of erythema is measured in mm.
- A TB Skin is considered positive if the induration is 15mm or greater in pt with no risk factors

Immunologic Test

Used to determine the presence of antigens and antibody reaction

Agglutination test- the Cold Agglutinins test may reveal the presence of high antibody titers confirming immunity to rubella (measles)

Precipitation tests – The C-reactive protein test and erythrocyte sedimentation rate may be elevated in some inflammatory diseases

Complement – Fixation Test – when elevated indication an inflammatory process

Immunofluorescence test identifies immunoglobulins, antibodies formed by the immune system
Other Tests

- Plain X-rays or Contrast studies
- CT scan
- MRI

These tests may be used to locate abscesses, identify displaced organs or structures, or detect changes in tissue.

Medical Management

- Supportive therapy that may be ordered while the disease runs its course
  - Rest
  - Fluids
  - Adequate nutrition
  - Tylenol - for fever
  - If disease warrants drug therapy
    - Antibiotics or Antimicrobials
    - Antiviral drugs

Medical Management

- Infected wounds may be
  - Debrided
  - Hydrotherapy
  - Wet to dry dressings
- Immunosuppressed pt may be given bone marrow or drug that increase WBC production
Nursing Management

- **HANDWASHING !!!**

- Collect data
  - Pt Medical History – ex: Lupus
  - Physical Assessment – Rash, fever
  - Subjective data – loss appetite

- Follow Standard Precaution
- Follow Transmission Based Precaution

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Nursing Management

- The nurse gives drug therapy and observes for evidence of improvement
  - A reduction in Temp
  - A reduction in Heart Rate
  - A reduction in WBC count

- Perform wound care as ordered
- Improved nutrition and fluid intake

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Nosocomial Infections

- Nosocomial Infections are infections acquired while in healthcare facility
  - Most common ????
  - No infection present at the time of admission

- Hospital pt are more susceptible to infection than well individuals
  - Broken skin
  - Poor Nutrition
  - Disease process
  - Treatment
Prevention and Control

- Follow Principles of medical and surgical asepsis when giving care
- Follow recommendation from agency’s infection control committee

Terminology

- Community acquired infections
  - Communicable or Contagious diseases
- Most have been contained or eliminated because of advances
  - Discovery and use of antibiotics
  - Development of immunizing agents
  - Guidelines for proper disposal of human wastes
  - Legislation controlling the preparation and sale of food
  - Immunization
  - Public Education

Childhood Immunizations

- Vaccine
  - Stimulates the body to produce antibodies against a specific disease organism to reduce the incidence of infectious disease
- Public education
- Immunization protect ALL people not just children
Client and Family Teaching

- Handwashing
- Daily bath - personal hygiene practices
- Clean home environment
- Immunizations current
- Precautions for travel
- Proper use / discard of tissues
- Avoidance of sharing personal items
- Safe sex practices

Client and Family Teaching

- Don’t infect others with colds - stay home
- Avoids crowds and public places during FLU season
- Understand that antibiotic therapy is not always appropriate for every infectious disease
- If antibiotics prescribed, take the full dose as ordered

Special Considerations

- Nutritional
  - Metabolism
  - Protein
  - Fluid
  - Infection control
- Pharmacological
  - Adverse reactions
  - Proper Administration
  - Antibiotics, Antipyretic
- Gerontonlogic