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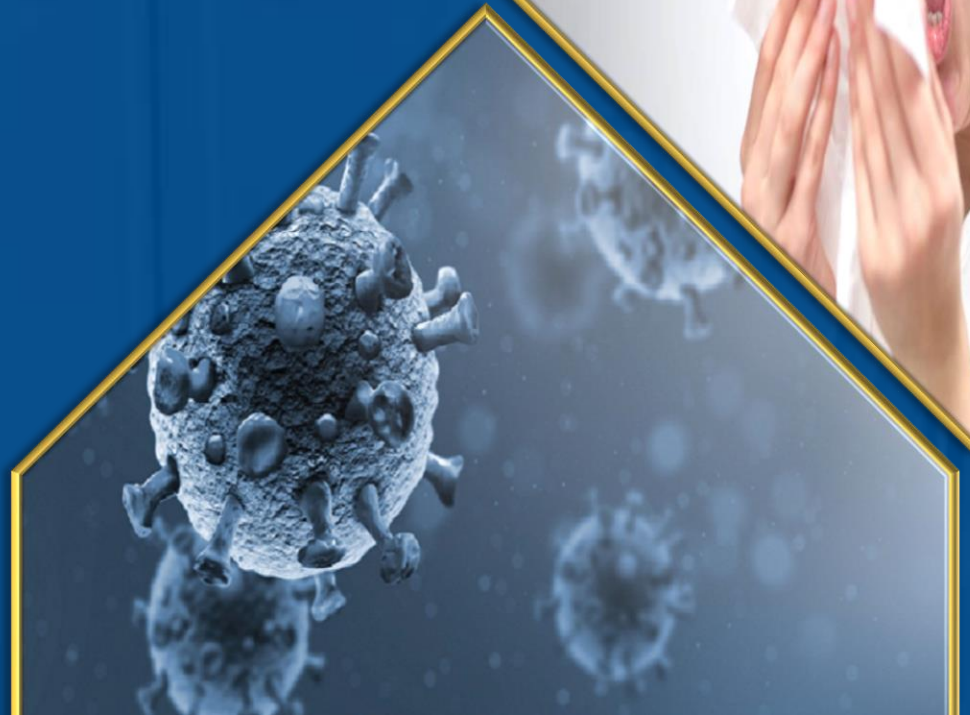
Infectious Disease

Primary Care Paramedicine



Module: 16

Section: 02a

Lecture Outline

- Introduction
- Microorganisms
- Contraction, transmission and stages of disease
- Infection control
- Assessment
- Selected diseases
- Preventing disease transmission

Introduction

- Infectious disease
  - Infestation of the body by biological organisms
  - Bacteria, viruses, fungi, protozoans, helminthes
- Patient
  - Early recognition and treatment can make a difference in how patient is treated
- Paramedic
  - Take necessary precautions (BSI, PPE)

Public Health Principles

- Epidemiology
- Identification and investigation
  - Index case
- Prediction
- Prevention

Public Health Agencies

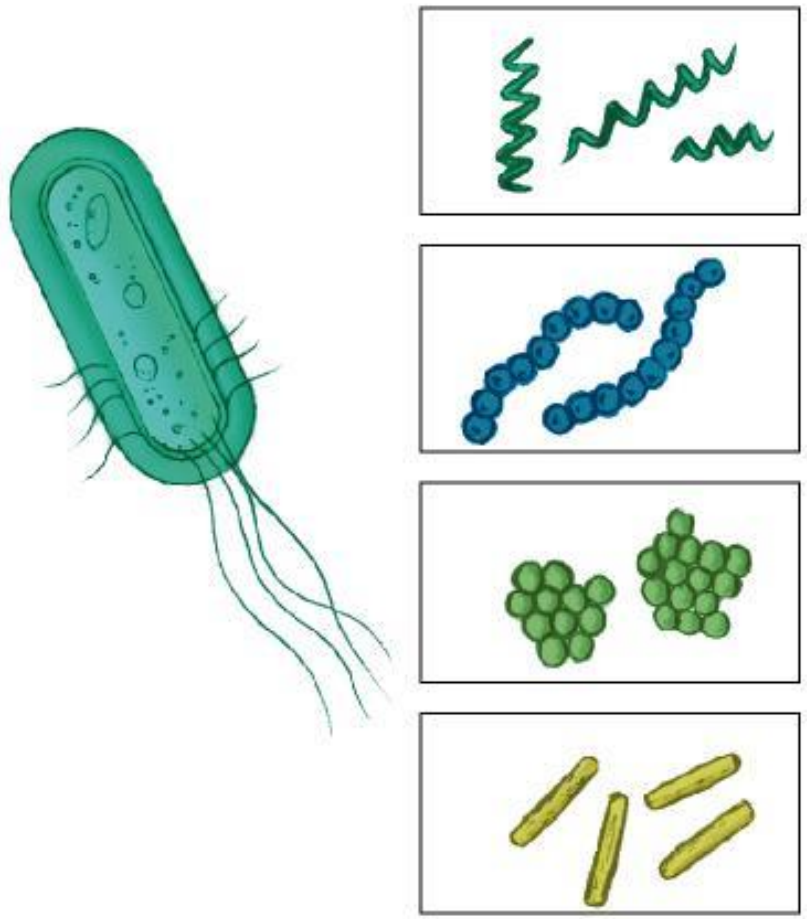
- Population and Public Health Branch (PPHB)
  - Federal group responsible for policies, programs and research
  - Five centres across the country
- Provinces/Territories
  - Responsible for health care delivery during an outbreak
  - Local medical officers of health

Microorganisms

- Most disease causing organisms are microscopic
- Normal flora
  - Organisms that live inside the body
  - Compete with invading pathogens
- Opportunistic pathogens
  - Ordinarily nonharmful bacteria that cause disease under unusual conditions

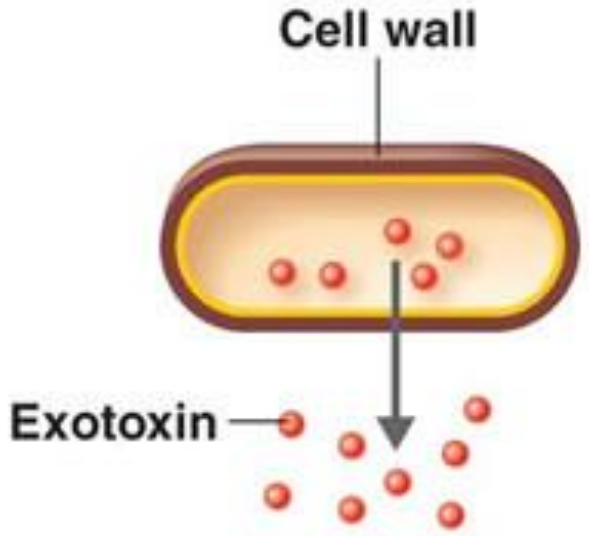
Bacteria

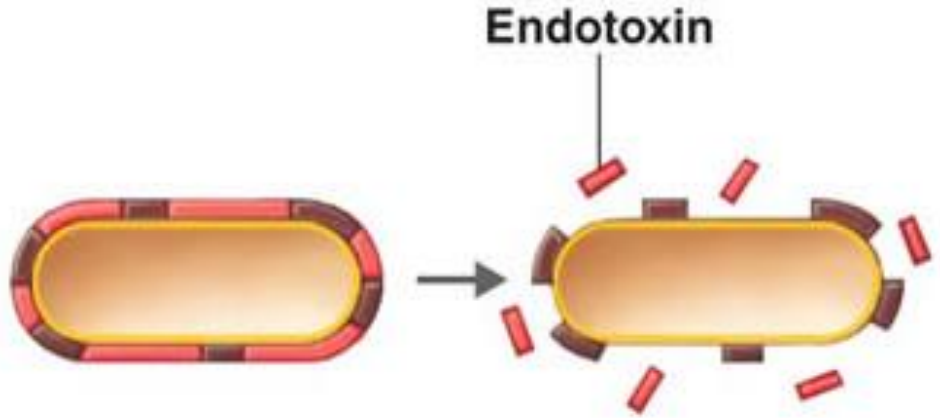
- Single celled organisms
  - Require a host to supply food and a supportive environment
- Classifications
  - Gram negative or positive
  - Cocci or spheres (e.g. staphylococcus)
  - Rods (e.g. enterobacter)
  - Spirals (e.g. spirochetes)



Bacteria

- Exotoxin
  - Proteins produced inside the pathogenic bacteria (most commonly gram-positive bacteria) as part of their growth and metabolism.
- Endotoxin
  - Lipid portions that are part of the outer membrane of the cell wall or gram-negative bacteria.
  - The endotoxins are liberated when the bacteria die and the cell wall breaks apart.





Antibiotics

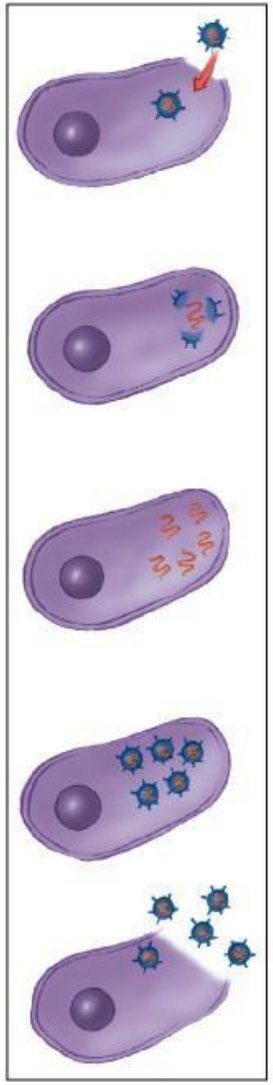
- Bactericidal
  - Capable of killing bacteria
- Bacteriostatic
  - Inhibit bacterial growth and reproduction
- Bacteria can alter cell membrane structure
  - Develop resistance
- Antibiotics alter normal flora
  - May lead to other complications

Viruses

- Much smaller
- Cannot reproduce by themselves
- Obligate intracellular parasites
  - Takes over cells protein synthesis mechanism
  - Kills host cell
  - Difficult to distinguish as foreign
- Infection always pathological

Viruses

- Host generally susceptible to a particular virus only once



Other Microorganisms

- Prions
  - Proteins folded so that protease can't act on them
  - Incurable diseases (e.g. Creutzfeldt-Jacob)
- Fungi
  - Plant like
  - Common cause of vaginal infections
- Protozoa
  - Single celled parasite with ability to move
  - E.g. malaria, gastroenteritis

Parasites

- Organism that lives in or on another
- Common cause of disease where sanitation is poor
  - Pinworms
    - Tiny worms that live in distal colon
    - Anal pruritis and infection
  - Hookworms
    - Passed in stool of infected animals
  - Trichinosis
    - Contracted by eating raw or inadequately cooked meat

Transmission of Disease

- Transmission based on interaction of host, infectious agent and environment
- Direct transmission
  - Person to person
  - Cough, kiss, sneeze, sexual contact
- Indirect transmission
  - Infected persons shed organisms
  - Food water, soil

Transmission of Disease

- Bloodborne
  - Contact with blood or bodily fluids
  - Risk increases with open wounds, active bleeding, increased secretions
- Airborne
  - Through air on droplets
  - Expelled during a cough or sneeze
- Fecal-oral
  - Hand to mouth

Chain of Transmission

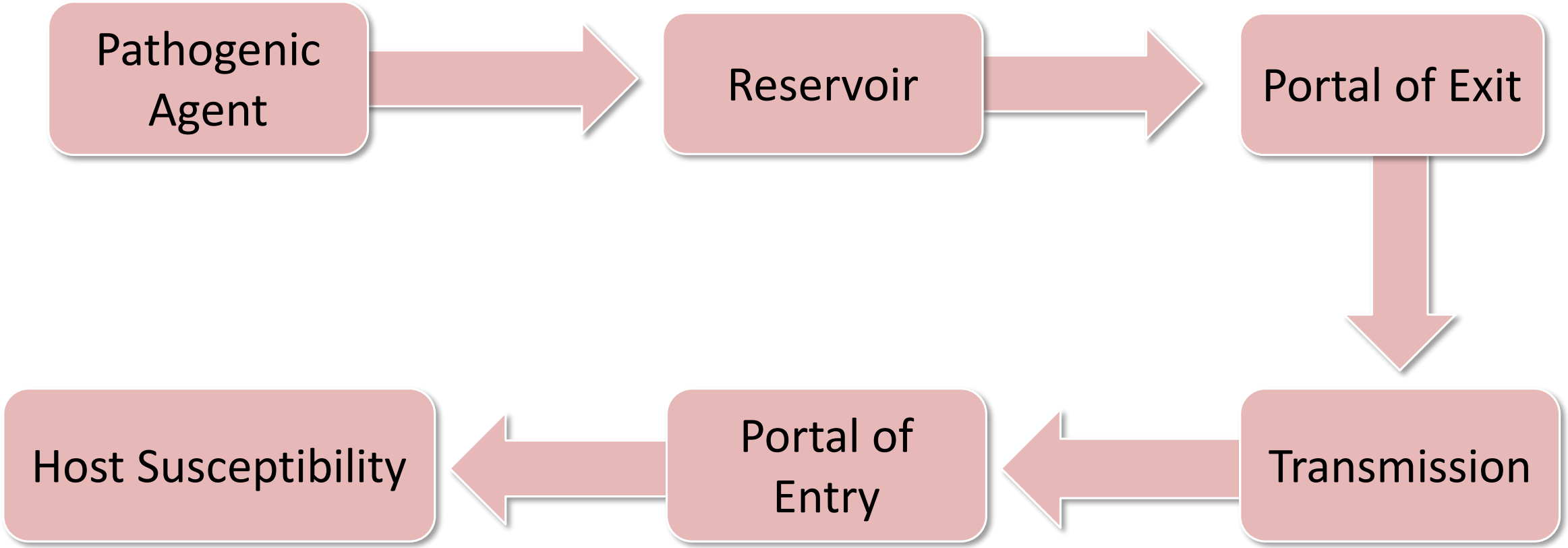


Table 37–1 Modes of Transmission of Infectious Diseases

Disease	Blood-borne	Airborne	Sexual	Indirect	Opportunist	Oral-Fecal
Hepatitis A						✓
Hepatitis B	✓					
Hepatitis C						
HIV	✓		✓			
Influenza		✓	✓	✓		
Syphilis			✓			
Gonorrhea			✓			
Measles		✓				
Mumps		✓				
Strep throat		✓			✓	
Herpes virus	✓		✓	✓		
Food poisoning		✓		✓		✓
Lyme disease	✓					
Pneumonia		✓			✓	

Factors Affecting Disease Transmission

- Mode of entry
- Virulence
- Number of organisms transmitted
- Host resistance
- Other host factors

Phases of Infection

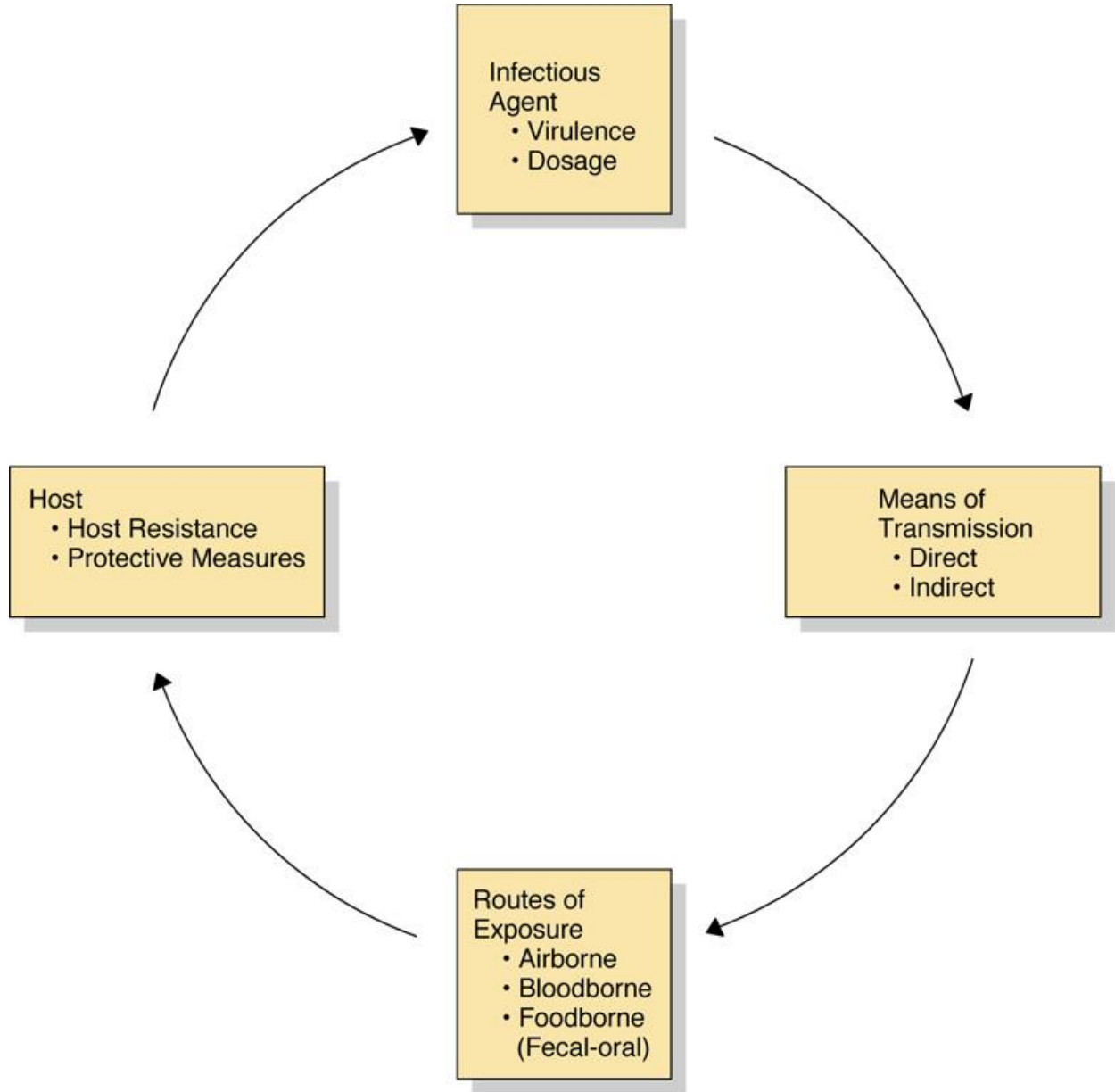
- Latent period
  - Host cannot transmit infectious agent
- Communicable period
  - Host can transmit infectious agent
- Incubation period
  - Seroconversion and the window phase
- Disease period

Preparation

- Maintain written operating procedures
- Health Canada standards and guidelines
- Adequate original and ongoing training
- PPE
- Treat all personal wounds

Preparation

- Access to personal hygiene facilities
- Exclude providers with infectious disease
- Vaccination and diagnostic tests
- Designated infection control officer
- Identify high risk processes



Infection Can Be Prevented
by Interrupting the Disease Process

Response

- Get as much information as possible before the response
- Prepare for patient contact
  - PPE
  - BSI
- Prepare mentally

Patient Contact

- Isolate all body substances (BSI)
- Wear appropriate PPE
- Only necessary personnel make contact
- Use disposable items whenever possible
- Properly dispose of waste
- Use extreme caution with sharps
- Adhere to infection control guidelines

Table 37-2 Guidelines for Prevention of Transmission of HIV and HBV to Prehospital Personnel

Task or Activity	Disposable Gloves	Gown	Mask	Protective Eyewear
Bleeding control with active bleeding	Yes	Yes	Yes	Yes
Bleeding control with minimal bleeding	Yes	No	No	No
Emergency childbirth	Yes	Yes	Yes	Yes
Blood drawing	Yes	No	No	No
IV insertion	Yes	No	No	No
Endotracheal intubation	Yes	No	Yes	Yes
EOA insertion	Yes	No	Yes	Yes
Oral/nasal suctioning; manually clearing airway	Yes	Yes	Yes	Yes
Handling/cleaning instruments with possible contamination	Yes	Yes	Yes	Yes
Measuring blood pressure	Yes	No	No	No
Giving an injection	Yes	No	No	No
Measuring temperature	Yes	No	No	No
Rescuing from a building fire	Yes	No	No	No
Cleaning back of ambulance after a medical call	Yes	No	No	No

Recovery

- Wash hands immediately after patient contact
- Wash all wounds
- Dispose of all biohazardous wastes
- Bag and label all soiled linen
- Decontaminate all clothing

Recovery

- Bag all linen, and label it infectious

Decontamination

- Low level
  - Use of disinfectants
- Intermediate level
  - Water and chlorine bleach
  - Germicides
- High level
  - Required for reusable devices
  - Chemical sterilizing solution
- Sterilization
  - Destroys all microorganisms
  - Autoclave or chemical sterilizing solution

Infectious Disease Exposure

- Immediate reporting
  - Facilitates patient care, risk assessment, protocol changes
- Postexposure
  - Evaluation and treatment
- Confidentiality
  - As per any patient

Assessment

- Ensure BSI procedures
- General indicators of infection
  - Unusual skin signs
    - Fever, weakness, profuse sweating, malaise, anorexia
  - Signs of localized infection
    - Redness, swelling, tenderness, capillary streaking, warmth
  - Presence of a rash or diagnostic skin sign

History

- When signs and symptoms began
- Presence of fever and use of antipyretics or other medications
- Presence of neck pain or stiffness
- Difficulty swallowing
- Similar past symptoms or illnesses

Secondary Assessment

- Evaluate for fever, hypotension, dehydration
- Other signs
  - Skin for temperature, hydration, color, or rash
  - Sclera for icterus
  - Reaction to neck flexion
  - Lymph node swelling or tenderness
  - Breath sounds
  - Hepatomegaly
  - Purulent lesions

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Diseases of Immediate Concern

- HIV/AIDS
- Hepatitis
- Tuberculosis
- Pneumonia
- Chickenpox
- Meningitis

Human Immunodeficiency Virus

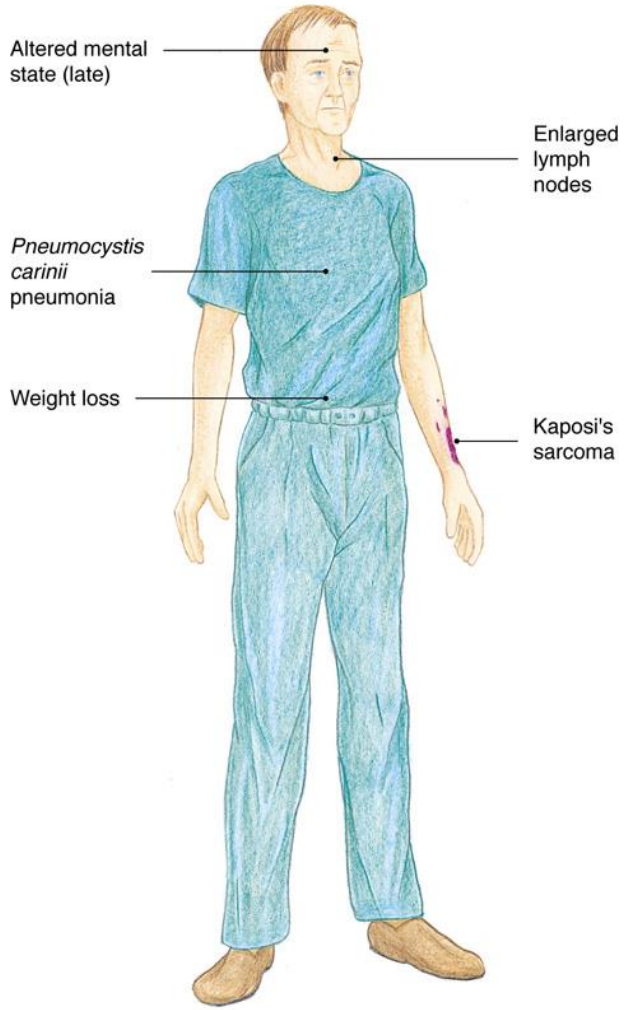
- Most discussed and feared pathogen of modern era
- Targets T-lymphocytes
  - Leaves patient susceptible to opportunistic infections
- Risk to public
  - Found in blood, blood products, and body fluids.
  - Common methods of transmission include sexual contact and shared needles.

Risk to Health Care Workers

- Transmission to health care workers is actually rare.
- Accidental needlesticks are the most common source.
- High-risk exposures
  - Involving a large volume of blood
  - Deep percutaneous injury
  - Actual intramuscular injection
  - High antibody-retrovirus titer in the source

Presentation

- Fatigue, fever, sore throat, lymphadenopathy, splenomegaly, rash and diarrhea.
- Kaposi's sarcoma.
- Secondary (opportunistic) infections and weight loss.
- Dementia, psychosis, and peripheral neurological disorders



Postexposure Prophylaxis

- Medical evaluation
- Triple therapy
  - Early aggressive therapy alters viral load and set point
- Postexposure counseling

Summary of HIV

- HIV rarely presents life threatening challenges
  - Often psychosocial
- Take appropriate infection control precautions
  - Should not be a barrier to professional care

Universal Precautions

- Use appropriate barrier precautions
- Wash your hands
  - After removal of gloves
  - Contamination with blood or other body fluids
- Take precautions to prevent injuries caused by sharp instruments
- Use mouthpieces with one-way valves, bag-valve-mask devices

Universal Precautions

- Do not put gloved hands to your mouth or wipe your face
- Refrain from direct patient contact if you have exudative or weeping skin lesions
- Pregnant health care workers should strictly adhere to precautions
- Disinfection of diagnostic or therapeutic equipment and supplies is mandatory

Hepatitis

- Inflammation of the liver caused by:
  - Viruses, pathogens, alcohol, medications
  - Most commonly viruses
- Clinical signs
  - Symptoms are similar regardless of type of infection
  - Headache, fever, weakness, joint pain, anorexia
  - Nausea, vomiting, and URQ abdominal pain
  - Jaundice, clay-colored stool, and dark urine develop as the disease progresses

Hepatitis A (HAV)

- Infectious or viral hepatitis
- Transmitted by fecal-oral route
- Typically is mild; many patients are asymptomatic
- Rarely serious and lasts 2–6 weeks.

Hepatitis B (HBV)

- Virus is transmitted through direct contact
  - Infected blood, semen, vaginal fluids, or saliva
- Risk is significantly higher for EMS providers
  - 5-35% of all needlesticks result in infection
- Vaccination is available and recommended for all EMS workers
- 60–80% of infected individuals are asymptomatic

Hepatitis

- Hepatitis C (HCV)
  - Primarily transmitted by IV drug abuse and sexual contact
  - Chronic infection that can cause active disease years later
  - May cause cirrhosis and end-stage liver disease
- Hepatitis D (HDV)
  - Exists only concurrently with HBV
- Hepatitis E (HEV)
  - Is similar to HAV but primarily associated with contaminated drinking water.

Tuberculosis

- Most common preventable adult infectious disease
- Mycobacterium tuberculosis
- Primarily affects respiratory system
- Airborne respiratory droplets
  - Also through mucous membranes, broken skin
  - Contaminated milk

Pathogenesis

- Bacteria enters lungs
  - Attacked by macrophages
  - Form granulomas
- Calcified lesions combine with lymph glands
  - Dormant until triggered (6-12 months)
- Reactive in areas of greatest oxygen tension
- May also spread to CNS

Presentation

- Can be highly nonspecific
- Chills, fever, fatigue
- Chronic cough
- Weight loss
- Night sweats
- Hemoptysis

EMS Response

- Skin testing
- Index of suspicion
- N95 and HEPA respirators
- Post exposure testing

Pneumonia

- Difficult to differentiate from CHF and pulmonary edema
- Acute lung inflammation
- Spread by droplet nuclei, direct contact and soiled linens
- Family of diseases
  - Bacteria, viruses, fungi

Assessment

- Consider possibility of community-acquired pneumonia
- Acute onset of chills, fever
- Dyspnea, pleuritic chest pain
- Cough
- Adventitious breath sounds
- In geriatric patients, the primary sign may be an altered mental state

Pneumonia

- Management
  - Support oxygenation and ventilation
  - Consider the possibility of TB
  - Consider placing a mask on yourself or the patient
- Post exposure
  - Routine vaccination is not necessary
  - Antimicrobial agents
  - Multidrug-resistant strains have been reported

SARS

- Severe Acute Respiratory Syndrome
- Atypical pneumonia
- Presentation
  - Respiratory illness of unknown etiology
  - High fever
  - Progresses to respiratory failure

SARS

- Transmitted through contact with secretions
- Standard contact and airborne precautions
- Assess patients in a separate area
- Assess travel history

West Nile Virus

- Occurs in bird population
- Transmitted by mosquitoes
- Begins as mild flu-like symptoms
- Can cross blood-brain barrier
  - Meningitis or encephalitis
- Patients not at risk for spreading disease
  - Environment you find them in is

Chickenpox

- Varicella zoster virus
- Self limiting disease that rarely causes complications
- Transmission
  - Airborne droplets
  - Direct contact with lesions

Presentation

- Respiratory symptoms
- Malaise, and low-grade fever
- Rash
  - May be the first sign of illness
  - May be limited or widespread
  - Often prolific on the trunk
- Fluid filled vesicles that rupture and form scabs
  - May leave permanent scars
- Can be lethal in adult immunocompromised patients.

Chickenpox

- Immunization
  - Immunity may be assessed through blood test
  - Vaccine now available
- EMS response
  - Universal precautions
  - Place mask on patient
  - Extensive decontamination of vehicle and equipment required

Meningitis

- Inflammation of the meninges
  - Bacterial or viral infections
- Respiratory droplets
  - Protected by intact epithelium
- Transmission factors
  - Host resistance factors, weather
  - Contact with oral secretions
  - Crowding, close contact, smoking

Presentation

- Incubation period of 4–10 days
- Fever, chills, headache
- Nuchal rigidity
- Rash, petechiae
- Arthralgia, lethargy, malaise
- Altered mental status, vomiting and seizures
- Brudzinski’s sign
- Kernig’s sign

Meningitis

- Immunization
  - Effective vaccine to several serotypes
  - Available to children
- EMS response
  - BSI
  - Post exposure prophylaxis within 24 hrs
  - Rifampin, ciprofloxacin

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Job Related Airborne Diseases

- Influenza
- Measles
- Mumps
- Rubella
- Respiratory syncytial virus
- Pertussis

Influenza

- Caused by viruses A, B, C
- Mutate often
- Leading cause of respiratory disease world wide
- Various strains cause epidemics
- Easily transmitted
  - Crowded spaces, close contact

Influenza

- Presentation
  - Fever, chills, malaise, muscle aches, nasal discharge, mild cough
  - Secondary infections
- Immunization
  - Annual
  - Based on statistical likelihood

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Measles

- Systemic disease caused by virus
- Highly contagious
- Characterized by reddish rash on fourth or fifth day
- Airborne droplets and direct contact

Measles

- Presentation
  - Similar to severe cold
  - Fever, conjunctivitis, photophobia, cough, and congestion
  - Characteristic rash
- Post exposure
  - Immunization highly effective in children
  - Masks
  - Hand washing critical

Mumps

- Viral infection
- Transmitted by airborne droplets and direct contact with saliva
- Occurs primarily in 5- to 15-year-old patients
- Generally benign and self-limiting
- Life long immunity conferred after infection

Mumps

- Presentation
  - Painful enlargement of salivary glands
  - Symptoms of cold with earache, difficulty chewing, and swallowing
- Complications with adult infection
- Immunization available
- BSI

Rubella

- Systemic virus cause by rubella virus
- Transmission by respiratory droplets
- Presentation
  - Sore throat, low-grade fever and fine pink rash
- Devastating in developing fetus
- Health care workers identified as source of numerous outbreaks
- Immunization critical

Respiratory Syncytial Virus (RSV)

- Viral infection
- Common cause of pneumonia and bronchiolitis
  - Associated with lower respiratory infections during winter
- Presentation
  - Runny nose and congestion
  - Wheezing, tachypnea
  - Signs of respiratory distress

Pertussis

- Whooping cough
- Bacterial infection
- Respiratory secretions or aerosolized
- Immunization not life long
  - Previously immunized adults may yet be at risk

Presentation

- Catarrhal phase (1-2 weeks)
  - Symptoms similar to cold
- Paroxysmal phase (up to 1 month)
  - Cough becomes severe
  - Thick mucous and vomiting
  - May lead to increased ICP
  - Increased intrapulmonary pressures
- Convalescent phase

Mononucleosis

- Viral infection caused by the Epstein-Barr Virus (EBV)
- Transmitted through oropharyngeal contact
- Presentation
  - Fatigue
  - Fever, severe sore throat, oral discharges
  - Enlarged, tender lymph nodes
- Recuperation may take several months

Herpes Simplex Virus Type 1

- Viral infection
- Transmitted in saliva
- Commonly infects the oropharynx, face, lips, skin, fingers and toes
- Presentation
  - Fluid-filled vesicles that develop into cold sores or fever blisters, then small ulcerations
  - Fever, malaise, and dehydration may occur also.

Epiglottitis

- Inflammation of the epiglottis
- True emergency in children
- Abrupt onset over several hours
  - Without immediate history of respiratory disease
- Presentation
  - Dysphonia, drooling, dysphagia, distress
  - Stridor, fever, sore throat

Croup

- Larygotracheobronchitis
- Viral illness causing upper-airway obstruction
- Presentation
  - Stridor
  - Harsh seal-bark cough
  - Nocturnal occurrence with acute distress, tachypnea and retractions

Pharyngitis

- Infection of the pharynx and tonsils
- Caused by a variety of bacteria and viruses
- Presentation
  - Sudden onset or sore throat and fever
  - Swelling of the palate, tonsils, and lymph nodes
- Common in 5- to 11-year-old patients

Sinusitis

- Infection of the paranasal sinuses
- Mucous or pus cannot drain
- Usually preceded by respiratory infection or exposure to allergen
- Presentation
  - Purulent or blood-tinged drainage
  - Congestion and pressure

Hantavirus

- Viral infection carried by rodents
- Transmission by inhalation of aerosols
  - Stirring up dried feces, urine, saliva
- Hanta virus pulmonary syndrome
- Presentation
  - Fatigue, fever, aches, nausea, vomiting, diarrhea and abdominal pain
  - Severe myocardial depression

Gastroenteritis

- Generalize disorder caused by viruses or bacteria
- Highly contagious through fecal-oral route
- Risks include age, travel, contaminate food and water supply
  - Self limiting in healthy adults
- Presentation
  - Nausea, vomiting, cramping or discomfort, anorexia and diarrhea

Food Poisoning

- Nonspecific term often applied to gastroenteritis
- Occurs suddenly by eating contaminated food
- Commonly a bacterial infection
- E. coli 0157:H7
  - Often found in undercooked meat
  - Produces a potent neurotoxin

Nervous System Infections

- Encephalitis
- Rabies
- Tetanus
- Lyme disease

Encephalitis

- Inflammation of the brain and its structures
- Viral infection that either:
  - Invades and replicates in cerebral neurons
  - Injures non-nervous tissue then invades
- Often co-exists with meningitis

Presentation

- Decreased level of consciousness
- Fever
- Headache
- Drowsiness
- Tremors
- Stiff neck/back

Rabies

- Viral infection affecting the nervous system
- Urban
  - Primarily transmitted by unimmunized domestic dogs and cats
- Sylvatic
  - Carried by other animals
- Transmitted through bites, nonintact skin and direct contact with a mucous membrane

Presentation

- Nonspecific prodrome (1-4 days)
  - Malaise, headache, chills, sore throat
  - Nausea, vomiting, diarrhea
- Encephalitic phase
  - Excessive motor activity, excitation
  - Confusion, hallucinations
  - Muscle twitched, tetany, fever
  - Focal paralysis
  - Can be fatal if untreated

Management

- Ensure scene safety
- Inspect and irrigate wound
- Do not bandage; allow the wound to drain
- Notify appropriate authorities so source animal's status can be determined
- Perform postexposure prophylaxis.

Tetanus

- Bacterial infection of the CNS
- Infection often occurs in minor wounds and burns
- Presentation
  - Rigidity of muscles occurs close to infection site
  - Generalized symptoms include pain and stiffness in the jaw, muscle spasms, and respiratory arrest
- Wounds cared for within 6 hours pose low risk
- Post exposure immunization

Lyme Disease

- Recurrent inflammatory disorder
- Caused by tick borne spirochete
- Common in people living near wooded areas
- Spring and summer
- Infection does not confer immunity

Presentation

- Early localized stage
  - Painless flat lesion (may be ring like)
- Early disseminated stage
  - Spreads to skin, cardiovascular and CNS
- Late stage
  - Months to years later
  - Same neurological deficits

Sexually Transmitted Diseases

- Gonorrhea
- Syphylis
- Genital warts
- Herpes simplex type 2
- Chlamydia
- Trichomoniasis
- Chancroid

Gonorrhea

- Gram-negative bacterial infection
- Transmitted by direct sexual contact with infected partner
- One of most commonly diagnosed communicable diseases in Canada

Gonorrhea

- Local
  - Men: painful urination and discharge
  - Can lead to epididymitis, prostatitis, urethral strictures
  - Women: no pain, minimal discharge
  - Risk of PID, abscesses, sterility
- Systemic
  - May cause sepsis, meningitis

Syphilis

- Bloodborne infection caused by spirochete
- Sexual intercourse or direct contact with a lesion
- 30% of exposures result in infection
- Lesions that affect almost any organ

Presentation

- Primary
  - Painless lesions or chancre
- Secondary (bacteremic)
  - Skin rash, CNS involvement
- Latent
  - Symptoms improve or disappear
- Tertiary
  - Progressive dementia

Genital Warts

- Viral infection
- Transmitted by contact
- Highly contagious
- Presentation
  - Cauliflower-like, fleshy growths on the penis, anus, labial surfaces and anal mucosa

Herpes Simplex Type 2

- Viral infection
- Transmitted by sexual contact
- Presentation
  - Vesicular lesions on penis, anus, rectum, mouth, vulva, buttocks, legs and perineum
  - Lesions that heal but occur throughout the patient's lifetime

Chlamydia

- Parasitic infection
- Transmission
  - Sexual activity
  - Hand-to-hand contact of eye secretions
- Presentation
  - Similar to gonorrhea
  - May cause blindness, sterility

Trichomoniasis

- Protozoan parasite infection
- Transmitted by sexual contact
- Males are usually asymptomatic carriers
- Presentation
  - Vaginal discharge, irritation of the perineum and thighs and dysuria
  - Often concurrent with gonorrhea

Chancroid

- Highly contagious bacterial ulcer
- Transmitted by direct sexual contact
- Begins with painful inflamed pustule
  - Penis, anus, urethra, vulva
- Swollen lymph nodes
- Linked to increased risk of HIV

Diseases of the Skin

- Impetigo
  - Bacterial infection
  - Highly contagious; spread by direct contact.
- Lice
  - Parasitic infestation
  - Commonly occurs on the scalp, trunk or pubic areas.
- Scabies
  - Mite infestation
  - Characterized by intense itching

Nosocomial Infections

- Infection occurring in hospitalized patients
- Pathogens
  - Often include antibiotic-resistant bacterial infections:
    - Vancomycin-resistant enterococcus (VRE)
    - Methicillin-resistant Staphylococcus aureus (MRSE)
  - Tuberculosis

Preventing Disease Transmission

- Recognition
- Personal accountability
- Immunization
- Index of suspicion
- Post exposure prophylaxis

Recognition

- Sensationalized media coverage of infectious disease outbreaks
- The significance of leading by example
- The serious personal and public health implications of infectious disease
- Importance of public education

Personal Accountability

- Do not work if you have:
  - Diarrhea
  - A draining wound
  - Mononucleosis
  - Common cold
  - Exposure to lice or scabies
  - Strep throat
  - Jaundice

Preventing Disease Transmission

- Personal Accountability
  - Ensure Personal Health
  - Maintain Current Immunizations.
    - MMR, hepatitis B, DPT, polio, chickenpox, influenza, and rabies (if appropriate)
  - Utilize BSI, PPE, and Infection Control Materials
  - Keep Your Education Current

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Summary

- Public Health Principles
- Public Health Agencies
- Microorganisms
- Contraction, Transmission and Stages of Disease
- The Body's Defense Against Disease
- Infection Control in Prehospital Care
- Assessment of the Patient with Infectious Disease
- Selected Infectious Diseases
- Patient Education
- Preventing Disease Transmission