Chapter 28
Infectious and Communicable Diseases

Lesson 28.1
Health Principles
Learning Objectives

• Identify general public health principles related to infectious disease.
• Describe the chain of elements necessary for an infectious disease to occur.

Learning Objectives

• Explain how internal and external barriers affect susceptibility to infection.
• Differentiate the four stages of infectious disease: the latent period, the incubation period, the communicability period, and the disease period.

Public Health and Infectious Disease

• Infectious disease
  – Any illness caused by specific germ
• Communicable disease
  – Infectious disease that can be passed from one person to another
  – Affect entire populations of people
    • Defined by location, age, socioeconomic status, and the relationships between groups
    • Display varying susceptibilities to infection and varying degrees of susceptibility
Public Health and Infectious Disease

• Factors that affect life cycle of infectious agent
  – International travel
  – Age distributions
  – Population settling and migration dictated by religion
  – Genetic factors
  – Effectiveness of treatment once infection established

Public Health and Infectious Disease

• When disease outbreak occurs, local, state, private, and federal health agencies and other organizations become involved in prevention and management
  – Local agencies
    • First line of defense in disease surveillance and outbreak
    • Include municipal, city, and county agencies such as health departments, fire departments, and EMS agencies

Public Health and Infectious Disease

• State agencies
  – Regulation and enforcement of federal guidelines
  – Required by statute or public law to meet or exceed federal guidelines
  – Recommendations for prevention and management of disease outbreaks
Public Health and Infectious Disease

• Private sector
  – Regional and national health care providers
  – Local and national health maintenance organizations
  – Laboratories (hospital and private)
  – Infection control and disease specialists
  – Groups influence protocols and guidelines for tracking diseases and responding to outbreaks

Public Health and Infectious Disease

• Federal and national organizations
  – Congress
    • Integral role in national health policy by passing public laws
    • Draft federal budget
  – U.S. Department of Labor’s Occupational Safety and Health Administration (OSHA)
  – Agencies under the U.S. Department of Health and Human Services
    • Centers for Disease Control and Prevention (CDC)
    • National Institute for Occupational Safety and Health (NIOSH)

Public Health and Infectious Disease

• Federal and national organizations
  – U.S. Department of Defense
  – Federal Emergency Management Agency (FEMA)
  – National Fire Protection Association (NFPA)
  – U.S. Fire Protection Administration (USFPA)
  – International Association of Firefighters (IAFF)
Public Health and Infectious Disease

- Local public health agencies
  - Can play important role during disease outbreak
    - Provide education to public service agencies
    - Vaccine distribution through immunization clinics
    - Outbreak surveillance
    - Tracking of infectious agents

Have you had an outbreak of a communicable disease in your region? How was it controlled?

Responsibility in Infectious Agent Exposure

- National concerns regarding communicable disease and infection control have resulted in
  - Public law
  - Guidelines
  - Standards
  - Recommendations to protect health care personnel and emergency responders from infectious diseases
Responsibility in Infectious Agent Exposure

- Plan components
  - Health maintenance and surveillance
  - Appointment of designated officer (DO)
    - Serve as liaison between agency and community health agencies involved in monitoring and responding to communicable diseases
  - Identification of job classifications
    - Specific tasks when exposure to blood-borne pathogens is possible
  - Schedule detailing when and how provisions of blood-borne pathogen standards will be implemented

Responsibility in Infectious Agent Exposure

- Plan components
  - Personal protective equipment (PPE)
  - Body substance isolation (BSI)
  - Procedures for evaluating exposure and postexposure counseling
  - Notifying and working with local health authorities and state and federal agencies regarding exposures
  - Personal, building, vehicle, and equipment disinfection and storage
  - Education of employees regarding disinfection agents

Responsibility in Infectious Agent Exposure

- Plan components
  - After-action analysis of the agency’s response
  - Correct disposal of needles and sharps in appropriate containers
  - Correct handling of linens and supplies that become contaminated with body fluids during patient care
  - Identification of agency and/or contracted personnel for counseling, authorization of acute medical care, and documentation
Guidelines, Recommendations, Standards, Laws

• To protect health care workers against spread of infection
  – OSHA requires personal protective equipment be made available to all employees considered at high risk for exposure to infectious diseases
  – Requires all employees be offered pre-exposure prophylaxis against hepatitis B through inoculation with hepatitis vaccines

Guidelines, Recommendations, Standards, Laws

• CDC and NFPA
  – Established similar guidelines, recommendations, and standards regarding protection of health care workers and emergency personnel from communicable disease
    • Regular testing for tuberculosis
    • Vaccination for measles in individuals who do not have immunity

Guidelines, Recommendations, Standards, Laws

• CDC
  – Classified infectious disease into two types: airborne and blood-borne
  – Lists less common communicable diseases
    • Diphtheria
    • Hemorrhagic fevers
    • Meningococcal disease
    • Plague
    • Rabies

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Guidelines, Recommendations, Standards, Laws

• Currently, medical facilities not required to test patients for any infectious disease

• If paramedics have significant exposure to blood or body fluids, may submit written notice to DO
  – DO must submit written request for determination to medical facility that treated patient
  – Medical facility must try to identify source patient and review any signs and symptoms patient may have that correspond to CDC list of infectious diseases

Guidelines, Recommendations, Standards, Laws

• After determining whether paramedic may have been exposed to an infectious disease, medical facility must notify DO within 48 hours of receiving request
  – If significant exposure and source patient is known, medical facility will usually ask for patient consent to test for HIV, HBV, and HCV infection
  – Paramedic will be counseled about need for PEP based on patient’s risk factors and need for safe sex until follow-up results are known

Guidelines, Recommendations, Standards, Laws

• If patient refuses to be tested or source patient is unknown, follow-up monitoring for paramedic is arranged
  – Follow-up monitoring for development of HIV, HBV, and HCV is important
    • PEP most effective if started immediately
What rights do you think paramedics had to obtain infectious disease information before the Ryan White law was passed?

Personal Responsibilities in Infectious Agent Exposure

• Paramedics should familiarize themselves with laws, regulations, national standards regarding infectious disease
  – Take personal protective measures against exposure to these pathogens
  – Must be aware of potential consequences of diseases for public health and through contact with family members and friends

• Designed to help prevent spread of infectious disease to public safety and emergency response workers
  – Follow local protocol regarding similar or additional precautions for personal protection
  – Be aware of individual responsibilities
Personal Responsibilities in Infectious Agent Exposure

- Individual responsibilities
  - Proactive attitude toward infection control
  - Maintenance of personal hygiene (esthetics of patient care)
  - Attention to wounds and maintenance of skin (external barrier to infection)
  - Effective hand washing after every patient contact using warm water and antiseptic cleanser
    - Waterless antiseptic cleanser when portable water is unavailable

- Individual responsibilities
  - Washing or disposing of work garments before entering home
  - Handling uniforms in accordance with agency’s definition of PPE
  - Proper handling and laundering of work clothes soiled with body fluids
    - With consideration for bathing and showering after work shift and before returning home

- Individual responsibilities
  - Preparing food and eating in appropriate areas
  - Maintenance of general physiological and psychological health to prevent distress
    - Can compromise immune system of healthy individual
Personal Responsibilities in Infectious Agent Exposure

- Individual responsibilities
  - Use of needleless or safe needle devices if available
  - Proper disposal of needles and sharps in appropriate containers
  - Proper disposal of body fluid-tinged linens and supplies
  - Awareness and avoidance of tendencies to wipe face and/or rub eyes, nose, or mouth with gloved hands
  - Knowledge of general classifications of exposure to determine extent of infection control measures applied to health care worker

Universal Precautions

- CDC published the Recommendations for Prevention of HIV Transmission Guidelines in Health-Care Settings (1987)
  - Recommended that universal precautions (universal blood and body fluid precautions) be used for all patients, regardless of blood-borne infection status
  - Since then, U.S. Food and Drug Administration (FDA) and CDC have worked together to identify body fluids to which universal precautions apply

Decontamination Methods and Procedures

- Guidelines for cleaning, disinfecting, and sterilizing patient care equipment
  - Established by the CDC, OSHA, EPA, USFA, and other agencies and organizations
  - Part of EMS agency’s protocols and standard operating procedures
### Decontamination Methods and Procedures

**• Sterilization** destroys all forms of microbial life
  
  - Used for instruments that penetrate skin or come in contact with normally sterile parts of body (e.g., scalpels and needles)
  
  - Methods used
    - Steam under pressure (autoclave)
    - Gas (ethylene oxide)
    - Dry heat
    - Immersion in EPA-approved chemical sterilant

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**• High-level disinfection**
  
  - Destroys all forms of microbial life except high numbers of bacterial spores
  
  - Used for reusable instruments that come into contact with mucous membranes (e.g., laryngoscope blades, endotracheal tubes)
  
  - Methods
    - Hot water pressurization
    - Exposure to an EPA-registered chemical sterilant

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**• Intermediate-level disinfection**
  
  - Destroys
    - *Mycobacterium tuberculosis*
    - Most viruses
    - Vegetative bacteria
    - Most fungi, but not bacterial spores
  
  - Used for surfaces that come in contact with intact skin (e.g., stethoscopes, blood pressure cuffs, splints)
  
  - Used for surfaces visibly contaminated with blood or body fluids
Decontamination Methods and Procedures

• Intermediate-level disinfection
  – Methods
    • EPA-registered "hospital disinfectant" chemical germicides that claim to be tuberculocidal on label
    • Hard surface germicides
    • Solutions containing at least 550 parts per million (ppm) free available chlorine

Decontamination Methods and Procedures

• Low-level disinfection
  – Destroys some viruses, most bacteria, and some fungi, but not M. tuberculosis or bacterial spores
  – Used for routine housekeeping
  – Used to clean up soiling when no blood is visible
  – Methods
    • EPA-registered "hospital disinfectants" (label carries no claim of tuberculocidal activity)

Decontamination Methods and Procedures

• Environmental disinfection
  – Cleans soiled surfaces in environment
  – Floors, ambulance seats, countertops
  – Surfaces should be disinfected with cleaners or disinfectant agents
Decontamination Methods and Procedures

• Body’s immune response to invading pathogen depends on
  – Size of pathogen
  – Pathogen’s ability to stimulate production of an antibody

Decontamination Methods and Procedures

• Often, peripheral phagocytic cells encounter pathogen first
  – Circulating B and T cells also scout for pathogens
  – Complex interactions occur among neutrophils, macrophages, and B and T cells
  – Cells assist each other in processing antigens that allow them to recognize and destroy invading pathogens

Decontamination Methods and Procedures

• B cell’s role is to produce antibody (humoral immunity)
  – Antibody coats pathogen and facilitates phagocytosis
  – Antibody can also fix complement
Decontamination Methods and Procedures

• Complement system is group of proteins that coat bacteria and help kill them directly
  – Proteins can have bacteria taken up by neutrophils in blood or by macrophages in tissues
  – T cells not only process antigen for B cells
    • Also include subpopulation of “killer cells”
    • Killer cells play major role in cell-mediated immunity

Decontamination Methods and Procedures

• Both humoral and cell-mediated types of immunity take time to work
  – Require previous exposure to mobilize specialized white cells
  – In time, white cells differentiate between antibodies
    • Then organize attack on foreign material
• Complement system recognizes and kills invaders on first sight
  – Does not take time to mobilize specialized responses
Reticuloendothelial System

- Works with lymphatic system to dispose of debris that results from immune system attack on invading organisms
  - Composed of immune cells in spleen, lymph nodes, liver, bone marrow, lungs, and intestines
    - Store mature B and T cells until immune system is activated

Infectious Disease Pathophysiology

- Infectious and communicable diseases
  - Second leading cause of death worldwide
  - Third most common cause of death in U.S.

Infectious Disease Pathophysiology

- Development and/or manifestations of clinical disease depend on
  - Virulence (degree of pathogenicity) of infectious agent
  - Number of infectious agents (dose)
  - Resistance (immune status) of host
  - Correct mode of entry
Factors all rely on intact chain of elements to produce infectious disease

- Pathogenic agent
- Reservoir
- Portal of exit from reservoir
- Environment conducive to transmission of pathogenic agent
- Portal of entry into new host
- Susceptibility of new host to infectious disease

Infectious Disease Pathophysiology

Pathogenic Agent

- Pathogens
  - Organisms that can cause disease in human host
  - Classified according to
    - Shape (morphology)
    - Chemical composition
    - Growth requirements
    - Viability
Pathogenic Agent

• Pathogens
  – Rely on host to supply their nutritional needs
  – Some metabolically equipped to survive outside host
  – Some can survive only in human cell
  – Some can survive for several hours outside host
    • Why blood products can be infectious

Pathogenic Agent

• Most bacteria are susceptible to certain drugs (antibiotics)
  – Drugs either kill bacteria or inhibit their growth
• Viruses
  – More difficult to treat
  – Reside in cells for most of their life cycle
  – Become intricately enmeshed in host cell’s deoxyribonucleic acid (DNA).

Pathogenic Agent

• Factors that affect pathogen’s ability to cause disease
  – Ability to invade and reproduce in host and mode by which it does so
  – Speed of reproduction, ability to produce toxin, degree of tissue damage that results
  – Potency
  – Ability to induce or evade immune response in host
Reservoir

- Pathogens
  - May live and reproduce in humans or other animal hosts
  - May live and reproduce in arthropod, plant, soil, water, food, other organic substance, or combination of reservoirs
  - When infected, human host may show signs of clinical illness
    - Host may be asymptomatic carrier (i.e., person who can pass pathogen to others without showing signs of illness)

Reservoir

- Life cycle of the infectious agent depends on three factors
  - Demographics of host
  - Genetic factors
  - Efficacy of therapeutic interventions once infection established

Portal of Exit

- Method by which pathogenic agent leaves one host to invade another
- Portal from human host depends on agent
  - Portal may be
    - Single or multiple
    - Genitourinary (GU) tract
    - Intestinal tract
    - Oral cavity
    - Respiratory tract
    - Open lesion
    - Any wound through which blood escapes
### Portal of Exit

- Time during which actively infectious pathogen escapes to produce disease in another host coincides with period of communicability
  - Period varies with each disease

### Mode of Transmission

- Determined by portal of exit and portal of entry
- May be direct or indirect
  - Direct transmission
    - Results from physical contact between source and victim
  - Indirect transmission
    - Organism survives on animate or inanimate objects for time without human host
    - Can be transmitted indirectly by air, food, water, soil, or biological matter

### Portal of Entry

- Means by which pathogenic agent enters new host
  - Ingestion
  - Inhalation
  - Percutaneous injection
  - Crossing of mucous membrane
  - Crossing of the placenta
Portal of Entry

- Time it takes for infectious process to begin in new host varies with disease and host susceptibility
  - Duration of exposure to pathogen and number of organisms required to initiate infectious process also vary
  - Exposure does not always produce infection

Think of a precaution or intervention that could break each of the links in this chain of disease transmission.

Host Susceptibility

- Influenced by person’s immune response
- Other factors of influence
  - Human characteristics
    - Age
    - Gender
    - Ethnic group
    - Heredity
Host Susceptibility

- Other factors of influence
  - General health status
    - Nutrition
    - Hormonal balance
    - Presence of concurrent disease
    - History of previous disease

- Other factors of influence
  - Immune status
    - Prior exposure to disease (conferring resistance)
    - Effective immunization against disease (conferring host immunity)
  - Geographical and environmental conditions

- Other factors of influence
  - Cultural behaviors
    - Eating habits
    - Personal hygiene
    - Sexual behaviors
Human Response to Infection Physiology

• Human body is regularly exposed to pathogens that can cause illness
  – Most people do not succumb to infectious disease
  – Protection provided by external and internal barriers
    • Act as lines of defense against infection

External Barriers

• First line of defense against infection is surface of body (external barriers)
  – Skin
  – Mucous membranes of digestive, respiratory, GU tract
  – Areas inhabited by indigenous flora
    • Agents that could produce disease if allowed access to interior of body
  – Forms a continuous closed barrier between internal organs and environment
Flora

- Nearly whole body surface is inhabited by normal microbial flora
  - Enhance effectiveness of surface barrier
  - Interfere with establishment of pathogenic agents in several ways
    - Compete with pathogens for space and nutrients
    - Maintain pH optimal for their own growth
    - pH can be incompatible with that needed for many pathogenic agents to survive
    - Secrete germicidal substances thought to stimulate immune system

Flora

- Normal flora play a key role in body’s defense
  - Some indigenous flora can be pathogenic under certain conditions
    - Can cause infection when skin or mucous membranes are interrupted
    - Can cause infection when flora are displaced from their natural habitat to another area of body

Skin

- Intact skin defends against infection
  - Prevents penetration
  - Maintains acidic pH level that inhibits growth of pathogenic bacteria
  - Microbes are sloughed from skin’s surface with dead skin cells
  - Oil and sweat wash microorganisms from skin’s pores
Gastrointestinal System

- Normal bacteria in GI system
  - Provide competition between colonies of microorganisms for nutrients and space
  - Help prevent growth of pathogenic organisms
  - Stomach acid may destroy some microorganisms
  - May deactivate their toxic products
  - Digestive system eliminates pathogens through feces

Upper Respiratory Tract

- Sticky membranes of upper airway protect against pathogens
  - Trap large particles
    - Particles may then be swallowed or expelled by coughing or sneezing

- Coarse nasal hairs and cilia also trap and filter foreign substances in inspired air
  - Prevent pathogens from reaching lower respiratory tract
- Lymph tissues of tonsils and adenoids
  - Allow rapid local immunological response to pathogenic organisms that may enter respiratory tract
Genitourinary Tract

- Natural process of urination and urine’s ability to kill bacteria help prevent infections in genitourinary (GU) tract
- Antibacterial substances in prostatic fluid and vagina also help prevent infection in GU system

Internal Barriers

- Internal barriers protect against germs when external lines of defense cannot
- Internal barriers include
  - Inflammatory response
  - Immune response
  - Share many of same processes and cellular components

Inflammatory Response

- Inflammation is local reaction to cellular injury
  - Occurs in response to microbial infection
  - When invasion occurs, line of defense is activated
  - Works to prevent further invasion of pathogen by isolating, destroying, or neutralizing microorganism
Inflammatory Response

• Usually is protective and beneficial
  – May initiate destruction of body's own tissue
  – May be destructive if response is sustained or directed against host's own antigens
• May be divided into three separate stages
  – Cellular response to injury
  – Vascular response to injury
  – Phagocytosis

Cellular Response to Injury

• Some cells are targets of specific inflammatory mediators (e.g., leukotrienes, histamine)
  – When injured, cell's metabolism is damaged
    • Leads to decreasing energy reserves in cells
    • When energy reserves are depleted, an accumulation of sodium ions causes cell to swell
Cellular Response to Injury

• Along with increasing acidosis, swelling further impairs cell’s ability to function
  – Leads to deterioration of cell membranes
  – Eventually, membranes of cells begin to leak
    • Contributes to cellular destruction, autolysis, and stimulation of inflammatory response in surrounding tissues

Vascular Response to Injury

• Localized hyperemia (increase in blood in area) develops after cellular injury
  – Produces edema
  – Leukocytes collect inside vessels
    • Release chemotactic factors (chemicals that attract more leukocytes to area)
    • Eventually migrate to injured tissue

What physical examination finding is related to this infection-fighting property?
Phagocytosis

- Leukocytes engulf, digest, and destroy invading pathogens
- Circulating macrophages clear area of dead cells and other debris
  - Ingestion of bacteria and dead cells (internal phagocytosis) releases chemicals that destroy leukocytes

Stages of Infectious Disease

- Progression from exposure to infectious agent to onset of clinical disease follows specific stages
  - Duration of each stage and potential outcomes vary, depending on infectious agent and individual host factors
  - Latent period
  - Incubation period
  - Communicability period
  - Disease period

Latent Period

- Begins when pathogen invades body
  - Infection has occurred but infectious agent cannot be passed (or "shed") to someone else or cause clinically significant symptoms
  - In some diseases (e.g., HIV), latent period is quite stable and can last several years
  - In others (e.g., influenza), latent period may last only 24 to 72 hours
Latent Period

- Stage of infectious disease is distinct from latent infection
  - Latent infection is inactive infection that can still shed and produce symptoms
  - Latent disease is characterized by periods of inactivity either before signs and symptoms appear or between attacks

Incubation

- Interval between exposure to pathogen and first onset of symptoms
  - Varies in length
  - Can range from hours to 15 or more years
- Infectious organism reproduces in host
  - Body is stimulated to produce antibodies specific for disease or antigen

Incubation

- Blood may test positive (sero-conversion) for exposure to disease
  - Window phase follows infection
  - In this phase, antigen is present but there is no detectable antibody
  - Blood tested for disease-specific antibodies in window phase may test negative even when infection is present
Communicability Period

- Follows latent period
  - Lasts as long as agent is present and can spread to other hosts
    - Clinically significant symptoms from infection may manifest during this period
  - Stage is variable
    - Often is major determining factor in ease of transmission
  - Communicability period and method of transmission can be altered in some diseases (e.g., tuberculosis, syphilis, gonorrhea)
    - Depends on stage of disease and primary site of infection

Disease Period

- Follows incubation period
  - Varies in duration, depending on specific disease
  - May be free of symptoms or it may produce overt symptoms
  - Can arise directly from invading organism or from body’s response to disease
  - Body may be able to rid itself of disease entirely

- Organism may become incorporated and lie inactive inside certain cells (latent disease)
  - Several viruses (e.g., HIV, hepatitis) can lead to latent infection
  - Resolution of symptoms does not mean infectious agent has been destroyed
Which of the four stages of infectious disease can overlap? What problems can the overlap (or overlaps) pose?

Lesson 28.2
HIV, Hepatitis, TB, Meningitis, and Pneumonia

Learning Objective
- Describe the mode of transmission, pathophysiology, prehospital considerations, and person protective measures for the human immunodeficiency virus (HIV), hepatitis, tuberculosis, meningococcal meningitis, and pneumonia.
### Human Immunodeficiency Virus

<table>
<thead>
<tr>
<th>Present in blood and serum-derived body fluids of people infected with virus</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Semen</td>
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<tr>
<td>- Vaginal</td>
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<tr>
<td>- Cervical secretions</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Directly transmitted person to person</th>
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<tbody>
<tr>
<td>- Anal or vaginal intercourse</td>
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<tr>
<td>- Across placenta</td>
</tr>
<tr>
<td>- By contact between infected blood or body fluids, mucous membranes, open wounds</td>
</tr>
<tr>
<td>Can be transmitted indirectly</td>
</tr>
<tr>
<td>- Transfusion with contaminated blood or blood products</td>
</tr>
<tr>
<td>- Transplantation of tissues and organs</td>
</tr>
<tr>
<td>- Use of contaminated needles or syringes</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Risk factors</th>
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</thead>
<tbody>
<tr>
<td>- High-risk sexual behavior</td>
</tr>
<tr>
<td>- IV drug abuse</td>
</tr>
<tr>
<td>- Transfusion recipient between 1978 and 1985</td>
</tr>
<tr>
<td>- Hemophilia or other coagulation disorders requiring blood products</td>
</tr>
<tr>
<td>- Infant born to an HIV-positive mother</td>
</tr>
<tr>
<td>- Sexually transmitted diseases (STDs)</td>
</tr>
<tr>
<td>* Especially for those that cause skin ulcerations</td>
</tr>
</tbody>
</table>
HIV Pathophysiology

• Results from one or two retroviruses that convert genetic ribonucleic acid (RNA) to DNA after entering host cell
  – HIV-1
  – HIV-2
  – Once retrovirus is inside cell, cell’s genetic material is altered into hybrid of part virus and part cell
    • Virus takes over cell to make more viral particles
    • When enough of viral particles have been produced, host cell ruptures

HIV Pathophysiology

• Host cell rupture destroys cell and releases virus into blood to seek new target cells
  – Cell receptor sought by HIV is T cell that has molecules called CD4 on its surface (CD4 T cell)
  – When HIV attaches itself to CD4 molecule, allows virus to enter and infect cells, damaging them in the process
  – CD4 T cell count is used to determine how active disease is
    • Very low count suggests severe disease

HIV Pathophysiology

• CD4 molecules also found on surface of certain nerve cells, and monocytes and phagocytes, which probably carry disease to other parts of body
  – Even though body develops antigen-specific antibodies to HIV, they do not protect against HIV
• Secondary complications generally are caused by opportunistic infections that develop as immune system deteriorates
HIV Pathophysiology

• Secondary infections
  – Pulmonary tuberculosis
  – Recurrent pneumonia
  – Pneumocystis carinii pneumonia
  – Kaposi sarcoma
  – Wasting syndrome
  – HIV dementia
  – Sensory neuropathy
  – Toxoplasmosis of CNS

Classification and Categories

• Average interval from transmission of HIV to development of serious complications is about 10 years if condition goes untreated
  – Time frame can vary greatly

Classification and Categories

• CDC has devised classification system for HIV (revised in 1993) with three categories based on CD4 T-cell count
  – Category 1: Cell count > 500/mL
  – Category 2: Cell count of 200 to 499/mL
  – Category 3: Cell count < 200/mL
  – As number of CD4 T cells decreases, risk and severity of opportunistic illness increase
  – After viral transmission, progression of HIV in adolescents and adults can be divided into three clinical categories: A, B, C
Classification and Categories

• Category A
  – Acute retroviral infection
    • Generally occurs 2 to 4 weeks after exposure
    • Clinical features include infectious mononucleosis-like illness with fever, adenopathy, sore throat
    • Febrile illness is self-limited
    • Usually lasts 1 to 2 weeks
    • Transient decrease is observed in CD4 T-cell count

• Category A
  – Seroconversion
    • Serological response with antigen-specific antibodies to HIV generally occurs 6 to 12 weeks after transmission
    • CD4 T-cell count returns to normal
  – Asymptomatic infection
    • May have persistent generalized lymphadenopathy (enlarged lymph nodes involving two noncontiguous sites other than inguinal nodes)
    • Gradual decline in CD4 T-cell count

What will probably happen if a sample is drawn for a blood test for HIV antibodies during the third week after exposure?
Classification and Categories

• Category B
  — Early symptomatic HIV
    • Usual CD4 T-cell count is 100 to 300/mL
    • Common complications include localized candidal infections (thrush, Candida esophagitis, Candida vaginitis), oral lesions, shingles, pelvic inflammatory disease, peripheral neuropathy, constitutional symptoms such as fever or diarrhea that last more than 1 month

• Category C
  — Late symptomatic HIV
    • Represents all acquired immunodeficiency syndrome (AIDS)-defining diagnoses found primarily with CD4 T-cell counts of 0 to 200/mL
    • Severe opportunistic infections
    • Bacterial pneumonia (e.g., P. carinii pneumonia)
    • Pulmonary tuberculosis
    • Debilitating diarrhea
    • Tumors in any body system, including Kaposi sarcoma
    • HIV-associated dementia
    • Neurological manifestations
Classification and Categories

- Category C
  - Advanced HIV
    - CD4 T-cell count of 0 to 50/mL
    - Limited life expectancy
    - Most die of AIDS-related complications

Personal Protection

- Strict compliance with universal precautions is only preventive measure health care workers can take against HIV
  - Chance of EMS personnel acquiring infection through exposure to infected blood appears to be low (0.2 to 0.44%)
  - HBV exposure is much greater occupational hazard
Personal Protection

- Risk to health care workers increases under following circumstances
  - Exposure involves large amount of blood
  - Can occur when
    - Piece of equipment is visibly contaminated with blood
    - Care of patient involves placing needle in vein or artery
    - Patient has deep injuries
  - Needle size and type (hollow bore or suture) and depth of penetration influence volume transferred to skin
  - Health care workers suffer 600,000 to 800,000 injuries from conventional needles and sharps each year

Personal Protection

- Risk to health care workers increases under following circumstances
  - Exposure involves patient with a terminal illness, possibly reflecting higher dose of HIV in late course of AIDS
    - Risk of exposure must be understood in terms of how exposure occurred and what factors were involved
    - Potential may appear high, probability actually may be quite low
    - Follow agency protocol for notification and reporting of significant exposures to any infectious disease

Postexposure Prophylaxis

- If exposure confirmed or suspected, immediately notify DO (per protocol)
  - Allows elective postexposure prophylaxis (PEP) to begin
  - Information on primary HIV indicates that systemic infection does not occur immediately
    - Leaves narrow window of opportunity in which postexposure antiretroviral intervention may modify viral replication
Postexposure Prophylaxis

- Several antiretroviral agents from at least four classes of drugs are available for treatment of HIV
  - Fusion inhibitors
  - Nucleoside/nucleotide reverse transcriptase inhibitors (NRTIs)
  - Non-nucleoside reverse transcriptase inhibitors (NNRTIs)
  - Protease inhibitors (PIs)
- After PEP, testing for HIV is performed 2 to 3 weeks after exposure
  - Performed again at 6 weeks, 3 months, 6 months, 1 year

Why would testing within 2 to 3 weeks of exposure be needed?

Psychological Reactions to HIV

- HIV is almost always a progressive disease with morbid late consequences
  - Patients are likely to feel and express anger about many aspects of their illness
    - Pain
    - Dying prematurely and without dignity
    - Social rejection and prejudice
  - Patient care should include helping these patients feel they can obtain acceptance and compassion from health care workers
Psychological Reactions to HIV

• Although no vaccine exists for HIV, many clinical trials are underway
  – Despite current limitations, progression of illness can be delayed with drug therapy and other strategies
    • Allows time for access to new therapeutic options

Hepatitis

• Viral disease that produces pathological changes in liver
  – Divided into three main classes
    • Hepatitis A (viral hepatitis)
    • Hepatitis B (serum hepatitis)
    • Hepatitis C (non-A/non-B hepatitis)

Hepatitis A Virus

• Most common type of viral hepatitis in U.S., accounting for 42,000 infections in 2005
• Acquired by ingesting HAV-contaminated food or drink
  – Acquired by the fecal/oral route
• Localizes in liver, reproduces, enters bile, and is carried to intestinal tract
  – Then shed in feces (usually occurs before onset of clinical symptoms)
Hepatitis A Virus

• Antibodies (anti-HAV) develop during acute disease
  – Develop late in convalescence
  – Once infected, person is immune to HAV for life
  – Only hepatitis virus that does not lead to chronic liver disease or chronic carrier state

• Many HAV infections are subclinical
  – Often manifest with influenza-like symptoms
  – About 1 in 100 patients with HAV suffers from sudden and severe infection that may require liver transplant

Hepatitis A Virus

• Immune globulin (IG) can provide temporary immunity to virus (i.e., 2 to 3 months)
  – Must be given before exposure to HAV or within 2 weeks after contact

• Vaccines approved for people 2+ years recommended for
  – People who have close physical contact with those who live in areas with poor sanitary conditions or who are traveling or working in developing countries

Hepatitis A Virus

• Vaccines approved for people 2+ years recommended for
  – Employees in certain job classes, such as the foodservice industry (may be required in some communities)
  – Men who have sex with other men
  – Users of illicit drugs
  – Children in populations that have repeated epidemics of hepatitis A (Native Alaskans, Native Americans, Pacific Islanders, and certain closed religious communities)
  – People who have chronic liver disease or clotting factor disorders
Hepatitis B Virus

• Infectious HBV particles are found in blood and in secretions containing serum (e.g., oozing, cutaneous lesions)
  – Also found in secretions derived from serum (e.g., saliva, semen, vaginal secretions)

• HBV affects liver and causes signs and symptoms described previously
• May produce chronic infection
  – Can lead to cirrhosis and other complications
  – Usually lasts less than 6 months, carrier state may persist for years

• Effects vary
  – Only low-grade fever and malaise (influenza-like illness) may occur, with complete resolution of symptoms
  – Extensive liver necrosis may develop that can lead to death
  – Other complications
  • Coagulation defects
  • Impaired protein production
  • Impaired bilirubin elimination
  • Pancreatitis
  • Hepatic cancer
Hepatitis B Virus

• Exposure generally occurs in one of five ways
  – Direct percutaneous inoculation of infectious serum or plasma by needle or transfusion of infected blood or blood products
  – Indirect percutaneous introduction of infective serum or plasma
    • Skin cuts or abrasions
    • Tattoo/body piercing
  – Absorption of infective serum or plasma through mucosal surfaces (e.g., eyes or mouth), transplacentally, or through contamination from mother’s infective blood at birth

Hepatitis B Virus

• Exposure generally occurs in one of five ways
  – Absorption of infective secretions (e.g., saliva or semen) through mucosal surfaces, as might occur during vaginal, anal, or oral sexual contact (but never fecal transmission), and straws shared in snorting drugs
  – Transfer of infective serum or plasma via inanimate environmental surfaces
  – Stable on environmental surfaces and can remain infective in visible blood for longer than 7 days

Why is information about exposure risks important to paramedics?
Pre-exposure Prophylaxis

• HBV is serious concern to all health care workers
  – CDC recommends and OSHA requires that HBV vaccines be offered to all health care workers
  – Vaccine sometimes is given to newborns
  – Several states now require immunization of children who are middle school age

Pre-exposure Prophylaxis

• Blood is most important potential source of HBV in workplace
  – Risk of infection is directly proportional to
    • Probability that blood contains HBV
    • Recipient’s immunity status
    • Efficacy of transmission

Pre-exposure Prophylaxis

• HBV vaccinations are available that provide protection for 18 years in those who respond to inoculation
  – HBV vaccination schedule generally requires three doses over 6 months
    • Intramuscular (deltoid) doses
    • For best protection, series should be completed before exposure occurs
    • Vaccinations currently available: Recombivax HB and Engerix-B
Postexposure Prophylaxis

- Postexposure prophylaxis may be indicated if unvaccinated person or person who has not completed vaccination schedule is exposed to HBV
  - Before treatment, blood test is performed to determine immunity to HBV
  - People who are not immune generally receive HBV vaccine and hepatitis B immune globulin
    - Antibody used in postexposure treatment to provide passive immunity to HBV

Hepatitis C Virus

- Blood-borne virus
  - Causes disease similar to HBV
  - Virus was associated with receipt of contaminated blood during transfusion before 1992
    - Accounts for more than 90 percent of post-transfusion hepatitis in U.S.
    - Currently, about 4 million Americans are believed to be infected with virus

Hepatitis C Virus

- Most often results from needle-stick and sharps injury
  - Of health care workers who become infected, 85 percent become chronic carriers
  - About 1/2 to 2/3 of those infected with HCV develop chronic hepatitis
  - One in five suffers severe liver disease, such as cirrhosis and liver cancer
  - No vaccine is available for HCV
Hepatitis C Virus

• Transmitted in same manner as other forms of hepatitis
  – Not easily spread through sexual contact
• Signs and symptoms of disease, when they occur, similar to those of other types of hepatitis
• Most people infected are asymptomatic

Signs and Symptoms

• Infection with any of causative viruses may not produce any symptoms
  – May cause typical hepatitis with abrupt onset of flulike illness that is followed by jaundice or dark urine, or both
  – Patient is most infectious during first week of symptoms

Signs and Symptoms

• Infection with any of causative viruses may not produce any symptoms
  – Within 2 to 3 months of infection, usually develops nonspecific symptoms
    • Anorexia
    • Nausea and vomiting
    • Fever
    • Joint pain
    • Generalized rashes
  – About 1 percent of patients hospitalized with HBV develop full-blown liver crisis and die
Patient Management

- Prehospital management is mainly supportive
  - Maintain circulatory status and prevent shock
- All health care workers involved in patient’s care must follow careful personal protective measures
  - Effective hand washing
  - Proper care in use of diagnostic and therapeutic equipment
  - Appropriate disposal of sharps

Tuberculosis

- Each year, 9 million new cases of tuberculosis (TB) occur worldwide, 2 million people die of disease
  - Reports of TB in U.S. had declined continually since turn of the 20th century
- In 1985, trend reversed (attributed to epidemic of HIV)
  - Incidence of TB among patients with HIV is 40 times incidence among people who are not infected with HIV

Tuberculosis

- Leading killer of people infected with HIV
  - Other risk factors
    - Immigration of people from areas with high prevalence of TB
    - Transmission of TB in high-risk environments, such as correctional facilities, homeless shelters, hospitals, and nursing homes
    - Deterioration of TB public health care infrastructure
Why is TB more prevalent in patients with HIV?

TB Pathophysiology

- Chronic pulmonary disease
  - Acquired through inhalation of dried-droplet nucleus containing tubercle bacilli
    - Mycobacterium tuberculosis
    - Mycobacterium bovis
    - Variety of atypical mycobacteria
  - Passed mainly by infected persons coughing or sneezing bacteria into air
    - Can also be passed through contact with sputum of infected person
  - Highest risk: people who share same air space as those with infectious TB
  - Transmission may occur by ingestion or through skin or mucous membranes
    - Less common
TB Pathophysiology

• Related to production of inflammatory lesions throughout body
  – Related to ability of TB bacillus to break through body’s natural defenses
  – Leads to formation of caseating granulomas (necrotic inflammatory cells) and TB cavities
  – May cause chronic and debilitating lung disease

TB Pathophysiology

• Related to production of inflammatory lesions throughout body
  – Susceptibility to mycobacterial infection generally is highest in
    • Children less than 3 years of age
    • Adults over age 65
    • Chronically ill
    • Malnourished
    • Immunosuppressed or immunocompromised

TB Pathophysiology

• Infection may remain dormant for indefinite time (often not causing disease)
  – May lead to active, contagious disease
  – As result, two TB-related conditions exist
    • Latent TB infection (LTBI)
    • TB disease
TB Pathophysiology

• Signs and symptoms of TB
  – Cough
  – Fever
  – Night sweats
  – Weight loss
  – Fatigue
  – Hemothysis

TB Pathophysiology

• Organ systems affected and associated complications
  – Cardiovascular system
    • Pericardial effusions
    • Lymphadenopathy (cervical lymph nodes are usually involved)
  – Skeletal system
    • Intervertebral disk deterioration
    • Chronic arthritis of one joint

TB Pathophysiology

• Organ systems affected and associated complications
  – Central nervous system (CNS)
    • Subacute meningitis
    • Brain granulomas
  – Systemic miliary TB (extensive dissemination by the bloodstream of tubercle bacilli)
TB Pathophysiology

• In U.S., estimated 10 to 15 million people are infected with *M. tuberculosis*
  – Without intervention, approximately 10 percent of these people will develop TB disease at some point in their lives
• Maintain high degree of suspicion for TB in individuals with undiagnosed lung disease, especially HIV-positive patients

TB Testing

• Signs and symptoms of initial infection may be minimal
  – Early infection can be detected using Mantoux tuberculin skin test (purified protein derivative [PPD])
    • Positive reaction to PPD test indicates past infection and presence of antibodies
    • Patients with positive test results usually have chest x-ray and acid-fast bacilli (AFB) sputum culture before treatment

• Counseling and HIV antibody testing should be offered to all people infected with TB
  – Medical management may be altered if HIV is present
  – By law, every state required to report cases of TB
  – Negative TB skin test result does not fully rule out TB infection
    • Especially in people with TB-like symptoms, HIV, or AIDS
    • Repeat skin test may be warranted 10 weeks after exposure
TB Testing

- Identification and early treatment of TB are important
  - All health care workers should receive routine evaluation
    - PPD
    - In some cases, chest x-ray and AFB culture
- Negative immune response does not preclude reinfection with subsequent exposure
- Paramedics should be aware of areas with high incidence of active TB in their service region

TB Patient Care and Protective Measures

- Prehospital care is mainly supportive
  - Universal precautions should be taken during patient care
    - Respiratory barriers for patient and paramedic
    - Surgical masks are insufficient for preventing inhalation of tuberculosis bacteria
    - Reduce number of droplet nuclei escaping from patient
    - Should be placed on patient during transport

- NIOSH recommends that health care workers use particulate filter respirators that filter at least 95 percent of airborne particles when caring for patients with tuberculosis
- Ambulance ventilation systems that include HEPA filtration and nonrecirculating ventilation cycle help prevent exposure
- After each call, disinfection of all patient care equipment should be performed
TB Treatment

• If effective treatment is begun without delay, TB is usually curable
  – Multidrug-resistant TB is on rise
  – Most patients with TB are started on a lengthy, four-drug regimen
    • Isoniazid (INH)
    • Rifampin (RIF)
    • Pyrazinamide (PZA)
    • Ethambutol (EMB) or streptomycin (SM)

TB Treatment

• If effective treatment is begun without delay, TB is usually curable
  – Monitor for drug side effects
    • Especially for signs and symptoms of hepatitis
  – Sputum and cultures usually become negative 3 to 8 weeks after start of therapy
Prophylactic Isoniazid

• INH
  – Recommended for
    • Those under 35 years old who have positive result on a PPD skin test
    • Those who have not previously been treated
  – Not routinely recommended for those under 35 years old because it may damage liver
  – Used if one or more of the following factors is present of following factors is present
    • Recent infection, as evidenced by PPD skin test conversion
    • Close or household contact with known case of infectious TB
    • Abnormal chest x-ray
    • Prolonged therapy with immunosuppressive drugs
    • HIV or other immunosuppressive disease

Prophylactic Isoniazid

• Patients who are receiving INH should avoid alcohol
  – Reduces chance for chemical- or drug-induced hepatitis
  – Side effects
    • Paresthesias
    • Seizures (toxic reaction)
    • Orthostatic hypotension
    • Nausea and vomiting
    • Hepatitis
    • Hypersensitivity to drug

Meningococcal Meningitis

• Also known as spinal meningitis
  – Inflammation of membranes that surround spinal cord and brain
  – Can be caused by variety of different bacteria, viruses, and other microorganisms
  – Major cause is Neisseria meningitidis
  – Spread by airborne pathogens
Meningococcal Meningitis

• Usual mode of transmission is prolonged, direct contact with upper respiratory secretions from infected person or carrier
  – Once inhaled, bacteria invade respiratory passages
  – Travel via blood to brain and spinal cord
  – As infecting agent spreads to more organs, causes toxic effects in involved organ system

Meningococcal Meningitis

• Meningitis strikes estimated 15,000 Americans each year
  – Estimated 2 to 10 percent of population may carry meningococci at any one time
  – Throat’s epithelial lining generally prevents germ from invading meninges and cerebrospinal fluid

Meningococcal Meningitis

• Although conversion from carrier to clinical disease is rare in developed countries, outbreaks of disease in U.S. have increased since 1990s
  – Partly because of increased rates of disease in people who may have common organizational affiliation or who live in same community
Infectious Agents Known to Cause Meningitis

• Other common pathogens that cause meningitis
  – *Streptococcus pneumoniae*
    • Second most common cause of bacterial meningitis in adults
    • Most common cause of pneumonia in adults
    • Most common cause of otitis media (middle ear infection) in children
    – *Haemophilus influenzae* type b (Hib)

Infectious Agents Known to Cause Meningitis

• Bacteria is spread by
  – Droplets
  – Prolonged personal contact
  – Extended contact with linen soiled with respiratory discharges

Infectious Agents Known to Cause Meningitis

• *H. influenzae*
  – Has same mode of transmission as *N. meningitidis*
• Vaccines for children were introduced in 1981
  – Before that time, *H. influenzae* was leading cause of bacterial meningitis in children 6 months to 3 years of age
  – Can be treated with antibiotics
  – 50 percent of infected children have lasting damage to nervous system
Infectious Agents Known to Cause Meningitis

- None that cause meningitis is as contagious as common cold or flu
- Not spread by casual contact or by simply breathing air where person with meningitis has been

Infectious Agents Known to Cause Meningitis

- Viral meningitis (aseptic meningitis) is syndrome generally associated with existing systemic viral disease
  - Enteroviral infection
  - Herpes virus infection
  - Mumps
  - Less commonly, influenza

Infectious Agents Known to Cause Meningitis

- Viral meningitis (aseptic meningitis) is syndrome generally associated with existing systemic viral disease
  - Symptoms similar to those of bacterial meningitis, usually less severe
  - In most cases is self-limited, and patient recovers fully
  - Patient may experience muscle weakness and malaise during prolonged convalescence
Signs and Symptoms

- Depend on patient’s age and general health
  - In infants
    - May be absent
    - Irritability
    - Poor feeding or vomiting
    - High-pitched cry
    - Fullness of fontanelle

- Depend on the patient’s age and general health
  - In older infants and children
    - Malaise
    - Low-grade fever
    - Projectile vomiting
    - Petechial rash
    - Headache
    - Stiff neck from meningeal irritation (nuchal rigidity)
Signs and Symptoms

- Diagnostic signs
  - Brudzinski sign
    - Involuntary flexion of arm, hip, and knee when neck is passively flexed
  - Kernig sign
    - Loss of ability in seated or supine patient to completely extend leg when thigh is flexed on abdomen
    - Patient usually can extend leg completely when thigh is not flexed on abdomen

What does a petechial rash look like?

Signs and Symptoms

- Risk of bacterial meningitis is most significant in neonates and in children 6 months to 2 years of age
  - Infection should be suspected in any patient with
    - Fever
    - Headache
    - Stiff neck
    - Altered mental status
    - Presence of petechiae and purpura
    - Underlying health problems (e.g., recent neurosurgery, trauma, or immunocompromise)
Signs and Symptoms

- If extensive meningeal involvement develops in toxic or debilitated patient, illness may be accompanied by:
  - Acute adrenal insufficiency
  - Convulsions
  - Coma
  - Disseminated intravascular coagulation (Waterhouse-Friderichsen syndrome)
    - In this case, death can occur in 6 to 8 hours

- Other conditions and long-term complications
  - Blindness and deafness (from cranial nerve damage)
  - Arthritis
  - Myocarditis
  - Pericarditis
  - Death can follow overwhelming infection

Immunization and Control Measures

- Vaccines are available for Hib, some strains of *N. meningitidis*, and many types of *S. pneumoniae*
  - Vaccines against Hib are very safe and highly effective
    - By 6 months of age, infants should have received at least three doses of Hib vaccine
    - Fourth dose ("booster") is recommended between 12 and 18 months of age
  - Vaccine against some strains of *N. meningitidis* is not routinely used in United States and is not effective in children under 18 months of age
    - Vaccine is sometimes used to control outbreaks of some types of meningococcal meningitis

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Immunization and Control Measures

- Vaccines to prevent meningitis caused by *S. pneumoniae*
  - Can prevent other forms of infection arising from bacterium
  - Ineffective for children under 2 years of age
  - Recommended for all people over age 65
  - Recommended for younger people with certain chronic medical problems

Patient Management and Protective Measures

- Patient management
  - Ensure adequate airway and ventilatory and circulatory support
  - Take protective measures when caring for patients who have signs and symptoms of meningitis
  - Universal precautions (with surgical masks on patient) should be used during care and transport
  - EMS agency should have exposure control plan for meningitis

Patient Management and Protective Measures

- Early diagnosis and treatment of bacterial meningitis essential
  - Diagnosis confirmed by finding bacteria in sample of patient’s spinal fluid
    - Obtained through spinal tap (lumbar puncture)
  - Disease is then treated using several antibiotics
  - Drugs to prevent disease are available for those who may have intimate contact with patient (e.g., family members)
Bacterial Endocarditis

- Also known as infective endocarditis
  - Inflammation of endocardium and one or more heart valves
  - Condition can be caused by variety of diseases that permit bacteria to enter bloodstream
    - Bacteria settle in heart and grow on valves of heart in structures called vegetation

Bacterial Endocarditis

- Structures damage heart valves and may cause them to leak
  - In severe cases, heart failure develops
  - If bacteria dislodge from valves and enter bloodstream, can cause stroke, vision impairment, severe damage to other organ systems
  - Bacterial endocarditis is most common in patients over 60 years of age as result of degenerative valve disease
  - About 20 percent of people die of disease within 5 years of diagnosis

Bacterial Endocarditis

- Other factors associated with development of endocarditis
  - IV drug use
  - Recent dental surgery
  - Permanent central venous access lines
  - Prior heart valve surgery
Bacterial Endocarditis

- Signs and symptoms of endocarditis may develop slowly or be acute
  - Fatigue
  - Weakness
  - Fever
  - Chills
  - Night sweats
  - Weight loss
  - Muscle aches and pains
  - Excessive sweating
  - Joint pain

- Red, painless skin spots located on the palms and soles (Janeway lesions)
- Red, painful nodes in pads of fingers and toes (Osler’s nodes)
- Jaundice
- Splinter hemorrhages under nails
- If patient’s heart valves are seriously affected, heart murmur, shortness of breath, chest discomfort, and dysrhythmias may be present

Bacterial Endocarditis

Other findings during physical examination may include
- Retinal hemorrhages
- Petechiae in conjunctiva
- Enlarged spleen
- Diagnosis made through blood cultures to identify bacteria and transesophageal echocardiograms
  - Hospitalization usually required along with long-term antibiotic therapy (4 to 6 weeks) and sometimes heart valve replacement
Bacterial Endocarditis

• Following recovery, prophylactic antibiotic therapy often prescribed before dental procedures and surgeries
  – Those with endocarditis are at higher risk of contracting disease again
  – Some patients will carry an endocarditis wallet card issued by AHA or other organizations to provide information to health care personnel

Pneumonia

• Pneumonia is acute inflammation of bronchioles and alveoli
  – Can be spread by droplets and by direct and indirect contact with respiratory secretions
  – Etiologic agents responsible for this disease may be
    • Bacterial
    • Viral
    • Fungal

• Pneumonia may affect several body systems
  • Respiratory system (pneumonia)
  • CNS (meningitis)
  • Ears, nose, throat (otitis, pharyngitis media)
Pneumonia

- Signs and symptoms
  - Sudden onset of chills, high-grade fever, chest pain with respirations, and dyspnea
  - Tachypnea and chest retractions (an ominous sign in children)
  - Congestion caused by development of purulent alveolar exudates in one or more lobes
  - Productive cough with yellow-green phlegm

Susceptibility and Resistance

- Susceptibility is increased by
  - Smoking
  - Pulmonary edema
  - Influenza
  - Exposure to inhaled toxins
  - Chronic lung disease

Susceptibility and Resistance

- Susceptibility is increased by
  - Aspiration of any form
    - Postalcohol ingestion
    - Near drowning
    - Regurgitation caused by gastric distention from bag-valve-mask ventilation
  - Extremes of age also appear to increase susceptibility to disease
Susceptibility and Resistance

• Other high-risk groups for pneumonia:
  – Sickle cell disease
  – Cardiovascular disease
  – Chronic respiratory disease (e.g., COPD, asthma, cystic fibrosis)
  – Asplenia (congenital absence or surgical removal of spleen)

Susceptibility and Resistance

• Other high-risk groups for pneumonia
  – Diabetes
  – Chronic renal failure (or other kidney disease)
  – HIV
  – Organ transplantation
  – Multiple myeloma, lymphoma, Hodgkin’s disease, lung cancer

Patient Management and Protective Measures

• Prehospital care
  – Provide airway support
  – Oxygen
  – Ventilatory assistance (as needed)
  – IV fluids
  – Cardiac monitoring
  – Transport
  – Bacterial pneumonia usually managed with analgesics, decongestants, expectorants, and antibiotic therapy
    • Patients generally do not need to be isolated from others
Which locations in your area are at high risk for influenza outbreaks?

Patient Management and Protective Measures

• Measures for protecting health care workers
  – BSI precautions
  – Effective hand washing
  – Airway barriers
  – Immunizations exist for some causes of pneumonia
• Not recommended for people who come in contact with patients who have disease

Lesson 28.3
Childhood Diseases, Influenza, and Mononucleosis
Learning Objectives

• Describe the mode of transmission, pathophysiology, signs and symptoms, and prehospital considerations for patients who have rabies or tetanus.
• List the signs, symptoms, and possible secondary complications of selected childhood viral diseases.
• List the signs, symptoms, and possible secondary complications of influenza, severe acute respiratory syndrome (SARS), and mononucleosis.

Tetanus

• Serious, sometimes fatal disease of CNS
  – Caused by infection of wound with spores of Clostridium tetani
  – Tetanus spores live mainly in soil and manure
    • Also found in human intestine
    • If spores enter tissue, multiply and produce toxin that acts on nerves controlling muscular activity
    • Dead or necrotic tissue is favorable environment for C. tetani

Tetanus

• About 500,000 cases of tetanus occur worldwide each year, mortality rate of 45 percent
  – Deaths often occur from wounds that appear too trivial for medical evaluation
  – Only about 100 cases of tetanus are reported annually in U.S.
  – Occur most often in patients 50 years of age or older
  – Relatively low number of tetanus cases in U.S. is result of immunization of general population with tetanus vaccines
Tetanus Signs and Symptoms

• Signs and symptoms
  – Most common symptom of tetanus is trismus (stiffness of jaw)
    • Also known as lockjaw because of accompanying difficulty in opening mouth
  – Muscular tetany (muscle spasms and twitching)
  – Painful muscular contractions in neck, moving to trunk
  – Abdominal rigidity (often first sign in pediatric patients)
  – Painful spasms (contortions) of the face (risus sardonicus), which produce grotesque smile
  – Respiratory failure

Patient Management

• Prehospital care goals: support vital functions
  – Aggressive airway management
    • Intubation
    • Surgical or needle cricothyrotomy
  – Muscle spasms
    • Treated with diazepam or lorazepam, benzodiazepines, or paralytic agents (per medical direction)
Patient Management

• Other indicated drugs
  – IV fluids
  – Magnesium sulfate
  – Narcotics
  – Antidysrhythmics

Patient Management

• After physician evaluation and stabilization
  – Administration of antitoxin (tetanus immune globulin [TIG]) to provide postexposure passive immunity
  – Treatment to eliminate toxin
  – Active immunization with tetanus toxoid
  – Wound care
• Most patients recover fully if they receive prompt treatment

When a patient with an open skin wound refuses care, do you ever explain the risks of tetanus infection?
Immunization

- Immunization usually started in children
  - Achieved using diphtheria-pertussis-tetanus (DPT) vaccination
    - Combined immunization against diphtheria (laryngitis, pharyngitis with discharge), pertussis (whooping cough), and tetanus
  - After initial immunization, children receive booster shot before starting elementary school
  - After that, booster shot is recommended every 10 years

- Counsel patients with recent wound about postinjury tetanus prophylaxis and effective wound care
  - If suspected that wound could carry tetanus, tetanus vaccination will not adequately prevent infection
    - Patient will need tetanus immunoglobulin
  - "Tetanus shot" (tetanus immunization) only prevents tetanus exposure in future wounds
  - All patients should be questioned about their tetanus immunization status
    - Boosters should be given every 10 years; 5 years for "dirty" wound
  - Recovery from infection does not confer immunity

Rabies

- Rabies (hydrophobia) is acute viral infection of CNS
  - Mainly affects animals
    - Can be transmitted from infected animal to human through virus-laden saliva
Rabies

- In U.S., wildlife rabies is common in skunks, raccoons, bats, foxes, dogs, wolves, jackals, mongooses, and coyotes
  - Healthy wild animals (e.g., skunks) are seldom seen by casual observance
  - High degree of suspicion for rabies is indicated for all animals found outside their natural habitat

Rabies

- Humans are highly susceptible to rabies virus after exposure to saliva in bite or scratch from infected animal
  - Several factors govern severity of infection
    • Severity of wound
    • Richness of nerve supply close to wound
    • Distance from wound to CNS
    • Amount and strain of virus
    • Degree of protection provided by clothing

Rabies Signs and Symptoms

- Incubation period between bite and appearance of symptoms ranges from 9 days to 7 years
  - Initial symptoms
    • Low-grade fever
    • Headache
    • Loss of appetite
    • Hyperactivity
    • Disorientation
    • Seizures
Rabies Signs and Symptoms

- Incubation period between bite and appearance of symptoms ranges from 9 days to 7 years
  - Often patient has intense thirst, but attempts to drink result in violent painful spasms in throat (hydrophobia)
  - Eye and facial muscles may become paralyzed as disease progresses
  - Without medical intervention, disease lasts 2 to 6 days, often resulting in death secondary to respiratory failure

Patient Management

- Physicians
  - Provide respiratory and cardiovascular support
  - Sedatives and analgesics
  - Thorough debridement of wound without sutures (if possible) is indicated
    - Allows free bleeding and drainage

Patient Management

- Human rabies immune globulin may be given to provide passive immunization
  - Rabies vaccine given by injections spread over several weeks
    - Injections no longer given in stomach
    - Tetanus prophylaxis and antibiotics may be indicated for treatment of bite wound
Has a case of rabies ever occurred in your community? What animal was implicated?

Patient Management

• Most cases are result of bite from a rabid dog
  – Must be considered with all mammal bites
  – Scene safety and use of BSI precautions during wound management are paramount
  – Law enforcement personnel and animal control authorities should be contacted to assist in scene control

Patient Management

• If given within 2 days of bite, immunizations almost always prevent rabies
  – For contact with open wounds or for exposure of mucous membranes to saliva
  – Given to people with high probability of contact with animal reservoirs
  – If animal is suspected of being rabid, should be killed by proper authorities and its brain should be examined for rabies inclusion bodies
    • If no inclusion bodies found, patient’s rabies treatment is stopped
Hantavirus

- Previously known to be associated with hemorrhagic fever with renal syndrome that occurs in Asia
  - Associated with syndrome of severe respiratory distress and shock
  - Syndrome has occurred in several areas of U.S.
  - Virus carried by rodents
    - Transmitted by inhalation of aerosol material contaminated with rodent urine and feces
  - Many forms occur in specific geographical areas

- Can cause significant disease in humans
- Patients are usually healthy adults who experience onset of fever and malaise
  - Followed several days later by respiratory distress
- Signs and symptoms
  - Fever
  - Chills
  - Headache
  - GI upset
  - Capillary hemorrhage

- With severe infection, oliguria, kidney failure, and hypotension occur
  - Death typically results from decreased cardiac output and eventual cardiovascular collapse
- Treatment is supportive and guided by medical direction
- Body substance isolation precautions are indicated
Viral Diseases of Childhood

- Incidence of childhood diseases has declined because of widespread immunization of children
  - Provides long-lasting immunity
  - Known to be 98 to 99 percent effective

Viral Diseases of Childhood

- All health care workers should use personal protective measures when caring for children with viral infections
  - Prevention
    - Protective immunization
    - Effective hand washing
    - BSI (including use of surgical masks for both paramedic and patient)
    - Careful handling of linens, supplies, and equipment that may be contaminated

Rubella

- Mild, febrile, highly communicable viral disease caused by rubella virus
  - Characterized by diffuse, punctate, macular rash
  - Disease usually transmitted by direct contact with nasopharyngeal secretions or droplet spray from infected person
  - May be passed transplacentally (producing active infection in fetus) and by contact with articles contaminated with blood, urine, or feces
  - After inoculation, virus invades lymph system
Rubella

• Enters blood and produces immune response
  – Subsequent rash spreads from forehead to face to torso to extremities (lasting 3 days)
    • Rash that lasts more than 3 days indicates presence of rubeola
  – Maximal communicability appears to be first few days before and 5 to 7 days after onset of rash
  – Complications rare
    • Young females sometimes develop self-limiting arthritis

Is there any way a paramedic can avoid rubella other than being immunized for it?
Rubella

- Congenital rubella syndrome (CRS) affects approximately 90 percent of infants born to women who were infected with rubella during first trimester of pregnancy
  - In first 6 months of life, associated with
    - Multiple congenital anomalies
    - Mental retardation
    - Deafness
    - Increased risk of death from congenital heart disease and sepsis
    - Infants with CRS shed large numbers of virus in their secretions

Rubella

- CDC recommends that all health care personnel receive immunization if not immune from previous rubella infection
  - Helps to reduce risk of exposure to themselves and those they treat
  - Immunization is not recommended for pregnant women
    - Due to theoretical risk that vaccine could cause developmental defects
    - As precaution, pregnant EMS workers should not be exposed to patients with rubella

Rubeola

- Acute, highly communicable viral disease
  - Caused by measles virus
    - Characterized by
      - Fever
      - Conjunctivitis
      - Cough
      - Bronchitis
      - Blotchy red rash
  - Virus found in blood, urine, pharyngeal secretions
    - Usually passed directly or indirectly through contact with infected respiratory secretions
Rubeola

• With exposure, virus invades respiratory epithelium, spreads via lymph system
  – May predispose person to secondary bacterial complications such as
    • Otitis media
    • Pneumonia
    • Myocarditis

Rubeola

• Most serious life-threatening complication is subacute sclerosing panencephalitis
  – Slowly progressing neurological disease
  – Marked by loss of mental capacity and muscle coordination
Rubeola

- Early (prodromal) symptoms that mark onset of disease
  - High fever
  - Nasal discharge
  - Conjunctivitis
  - Photophobia
  - Cough
  - 1 or 2 days before rash emerges, white spots noted on inside of cheek (Koplik spots)
  - Dermal rash begins few days after respiratory tract involvement

Rubeola

- Rash is red and maculopapular
  - Spreads from forehead to face, neck, and torso and eventually to feet, usually by third day
  - Onset of rash coincides with production of serum antibodies
  - Uncomplicated cases usually last 6 days
  - Recovery from illness confers lifelong immunity

Mumps

- Acute, communicable systemic viral disease caused by mumps virus
  - Characterized by localized edema of one or more salivary glands (usually parotid)
  - Swelling may affect both or only one side of neck
  - In some cases, involvement of other glands also occurs
  - Passed through direct contact with saliva droplets of infected person
Mumps

• Invades and multiplies in parotid gland or upper respiratory passages
  – From there enters bloodstream and localizes in glandular or nervous tissue
  – Parotid, testes, and pancreas are most frequently involved glands
  – When occurs after onset of puberty, may cause painful inflammation of testicle (orchitis) and testicular atrophy
    • Sterility is rare

Mumps

• Invades and multiplies in parotid gland or upper respiratory passages
  – Intensity of symptoms in mumps varies
    • 30 percent of infections are asymptomatic
  – Immunity after recovery lifelong
  – Placental transfer of antibodies sometimes occurs
Why are some viral diseases of childhood still seen despite widespread immunization?

Chickenpox

- Common childhood disease caused by varicella-zoster virus
  - Member of herpes virus family
  - Passed by direct and indirect contact with droplets (mainly airborne) from respiratory passages of infected person
  - Exposure to linen tainted with vesicular or mucous membrane discharges of infected people has been implicated

Chickenpox

- Highly communicable
  - Characterized by
    - Sudden onset of low-grade fever
    - Mild malaise
    - Skin eruption that is maculopapular for few hours and vesicular for 3 to 4 days, leaving a granular scab
Chickenpox

• At first, skin lesions appear on trunk
  – Usually progress to extremities
  – Crops of skin eruptions (each associated with itching) usually are more abundant on covered areas of body
  • Scalp, conjunctivae, and upper respiratory tract may also be affected

Chickenpox

• Appearance of crops of vesicles differentiates chickenpox from smallpox
  – Smallpox has vesicles of same age
  – Treatment is symptomatic
  – Disease is self-limited
Chickenpox

- Complications
  - Secondary bacterial infections
  - Aseptic meningitis
  - Mononucleosis
  - Reye syndrome

Chickenpox

- After recovery, virus is thought to remain in body in asymptomatic latent stage
  - Possibly localized in dorsal root ganglia
  - Virus may reactivate during periods of stress or immunosuppression

Chickenpox

- After recovery, virus is thought to remain in body in asymptomatic latent stage
  - May produce shingles
    - Vesicles associated with shingles appear on skin area supplied by sensory nerves of single group or associated groups of dorsal root ganglia
    - Unlike chickenpox, shingles not passed through respiratory droplets
    - Can cause chickenpox in susceptible individuals who come in contact with open skin lesions
Chickenpox

- Antiviral drugs may shorten duration of symptoms and pain in older patients
  - EMS personnel who have not had chickenpox should consider receiving vaccine
    - Data indicate that adult antibody production occurs in 78 percent of patients after one dose
    - Occurs in 99 percent of patients after two doses
    - Should not be given to people who received high doses of systemic steroids in previous month

- About 5 percent of those who receive vaccine develop rash
  - Some develop frank chickenpox, which is very debilitating in adults
  - To protect fetus, varicella-zoster immune globulin (VZIG) is recommended for pregnant women with significant exposure to chickenpox who do not have history of previous exposure
Pertussis

- Pertussis is infectious disease that mainly affects infants and young children
  - Caused by *Bordetella pertussis* and is spread by direct contact with discharges from mucous membranes contained in airborne droplets
  - Causes inflammation of entire respiratory tract
  - Causes subtle onset of cough that becomes paroxysmal in 1 to 2 weeks
    - Cough can last 1 to 2 months

Pertussis

- Coughing episodes are violent (sometimes without intervening inhalation), causing high-pitched inspiratory “whoop”
  - End with expulsion of clear mucus and vomiting
- Before introduction of vaccine against pertussis in 1950s, disease killed more children in U.S. than all other infectious diseases combined
  - Incidence of disease has increased since 1990, with disproportionate increase in adolescents and adults

Pertussis

- Vaccine usually given in combination with diphtheria and tetanus (DPT) vaccines to children at 2, 4, and 6 months of age
  - Booster dose is given at age 5
Pertussis

- Ability to spread thought to be greatest before onset of paroxysmal coughing
  - Need for BSI and surgical mask protection for paramedic and patient
  - Erythromycin is known to shorten communicability period, can reduce symptoms only if given during incubation period.
  - Infection usually provides immunity
    - Attacks after immunization in older children and adults indicate that immunity may diminish over time

Other Viral Diseases

- Other viral diseases easily transmitted during course of patient care include influenza, mononucleosis, and herpes simplex type 1 (HSV-1) infection
- As with all other contacts with patients who may have infectious disease, BSI precautions indicated during patient care

Influenza

- Respiratory infection spread by influenza viruses A, B, C
  - Popularly known as “the flu”
  - Spread by virus-infected droplets coughed or sneezed into air
  - Usually occurs in small outbreaks or in epidemics
  - Resistance is normally conferred after recovery
    - Only to specific strain or variant
Influenza

• Signs and symptoms
  – Chills
  – Fever
  – Headache
  – Muscular aches
  – Loss of appetite
  – Fatigue

• Symptoms are followed by upper respiratory infection and cough that lasts for 2 to 7 days
• Patient management mainly supportive
• Mild cases of viral infection usually are not treated

• Severe cases may result in secondary bacterial infection (e.g., *S. pneumoniae*)
  – Can be fatal
• Other viral respiratory diseases that can lead to bacterial complications
  – Acute afebrile viral respiratory disease (excluding influenza)
  – Acute febrile respiratory disease
Influenza

• Both diseases may cause illnesses in upper and lower respiratory tract
  – Pharyngitis
  – Laryngitis
  – Croup
  – Bronchitis
  – Bronchiolitis

Influenza

• Flu vaccines contain killed strains of type A and type B virus that are known to be currently in circulation
  – May help prevent infection
  – Nasal spray flu vaccine, FluMist (virus vaccine live, intranasal), has also been approved for protection against influenza A and B viruses in healthy people between 5 and 49 years of age
    • Immunity does not last long
    • Vaccine must be repeated each year just before start of the flu season
    • Health care workers should be immunized in fall of each year with current vaccine

Influenza

• Amantadine, rimantadine, or zanamivir may be given to hospitalized patients to protect against influenza A
• Despite advances in prevention and treatment, over 36,000 people die each year in U.S. from influenza and its complications
Will you get the influenza vaccine? What influenced your decision?

Mononucleosis

- Often referred to as “mono”
  - Caused either by Epstein-Barr virus (EBV) or by cytomegalovirus (CMV)
  - Both are members of herpes virus family
  - Spread from person to person via oropharyngeal route and saliva
  - Blood transfusions also can be mode of transmission
  - Resultant clinical disease is rare

Mononucleosis

- Most people with a healthy immune system are able to fend off infection even after significant exposure
  - Transmission from care givers to young children is common
  - About 90 percent of people over 35 years have antibodies to CMV or EBV
    - Probably result of mild, childhood infection, often attributed to common cold or flu
    - Previous infection with EBV generally confers high degree of resistance to future exposures
Mononucleosis

• Signs and symptoms
  – Appear gradually
  – Fever (which may last for weeks)
  – Sore throat
  – Oropharyngeal discharges
  – Lymphadenopathy (especially posterior cervical)
  – Splenomegaly with abdominal tenderness
  – About 10 percent of people also develop generalized rash or darkened areas in mouth that resemble bruises

Mononucleosis

• Recovery usually occurs in few weeks
  – Some take months to regain their former level of energy
  – May remain carrier for several months after symptoms disappear
  – No immunization available

Lesson 28.4

STDs, Communicable Diseases, and Transmission Prevention
Learning Objectives

• Describe the mode of transmission, pathophysiology, prehospital considerations, and personal protective measures for sexually transmitted diseases.
• Identify the signs, symptoms, and prehospital considerations for scabies and lice.

Learning Objectives

• Outline the reporting process for exposure to infectious or communicable diseases.
• Discuss the paramedic’s role in preventing disease transmission.

Sexually Transmitted Diseases

• Sexually transmitted disease (STD)
  – Disease that can be passed from person to person through sexual activity
  – May be transmitted to another person even when infected person has no symptoms
  – Over 20 pathogens identified as belonging to group of diseases (including HBV and HIV)
  – Other common STDs
    • Syphilis
    • Gonorrhea
    • Chlamydia
    • Herpes virus infections
Sexually Transmitted Diseases

- Several pathogenic agents are responsible for host of STDs
  - Bacteria
  - Viruses
  - Protozoa
  - Fungi
  - Ectoparasites

Sexually Transmitted Diseases

- Pathogens can produce multiple disease syndromes
  - Patients with STD syndromes often have multiple STDs
  - Infections usually cause short-lived cellular immune response
  - Can produce longer-lasting humoral antibody response
  - Neither of these protects against future exposures

Syphilis

- Systemic disease
- Characterized by
  - Primary lesion
  - Secondary eruption involving skin and mucous membranes
  - Long latency periods
  - Late, seriously disabling lesions of skin, bones, viscera, CNS, and cardiovascular system
Syphilis

- Results from penetration of skin, whether intact or broken, by bacteria *Treponema pallidum*
  - Common modes of transmission include direct contact with fluid or pus from lesions on skin and mucous membranes, blood transfusions or needle sticks (rare), and congenital transmission

Syphilis

- After penetration, organisms travel (within hours) to lymph nodes
  - From there are carried throughout body
  - After initial infection, syphilis follows well-defined stages of disease
  - Can be treated with antibiotic therapy
  - No immunization available
  - Estimated that 30 percent of exposures result in infection

Primary Stage

- Within 10 to 90 days of exposure, primary lesion, or chancre, develops at site of initial invasion
  - Surface of the chancre usually crusted or ulcerated
  - Varies in size from 1 to 2 cm in diameter
  - Usually single and painless
  - Generally heals spontaneously within 1 to 5 weeks
  - Highly communicable during this stage
Secondary Stage

- Begins about 2 to 10 weeks after appearance of primary lesion
  - Lasts for 2 to 6 weeks
  - Systemic symptoms
    - Headache
    - Malaise
    - Anorexia
    - Fever
    - Sore throat
    - Lymphadenopathy
    - Bald spots in area of infection

Secondary Stage

- Begins about 2 to 10 weeks after appearance of primary lesion
  - Lasts for 2 to 6 weeks
  - Systemic symptoms
    - Bald spots in area of infection
    - Rash, which usually is bilaterally symmetrical and often involves palms and soles
    - Painless, wartlike regions (condylomata lata), which are extremely infectious, may also be found in moist, warm sites (e.g., inguinal area)
    - CNS, eyes, bones, joints, or kidneys may be affected
Why do you think a patient in the secondary stage of syphilis would call EMS?

Latency

• Follows secondary stage in untreated individuals
  – May range from 1 to 40 years or more
  – Recurrent episodes of secondary stage symptoms with subclinical infection may occur
    • Happens in about 25 percent of cases
    • About 33 percent progress to tertiary syphilis
    • Remainder remain free of symptoms

• Tertiary syphilis
  – Infectious involvement of the skin, CNS, and cardiovascular systems

Latency

• Tertiary syphilis manifestations
  – Skin
    • Granulomatous lesions (gummas) on skin (painless) and bone (painful)
  – Central nervous system
    • Paralysis
    • Tabes dorsalis (spinal column degeneration characterized by a wide gait and ataxia ["syphilitic shuffle"])")
    • Loss of reflexes, pain, and temperature sensation
    • Meningitis
    • Psychosis
Latency

- Tertiary syphilis manifestations
  - Cardiovascular
    - Cerebrovascular occlusion
    - Dissecting aneurysm of the ascending aorta
    - Myocardial insufficiency; aortic necrosis (which can lead to aortic rupture and death)

Gonorrhea

- Caused by bacterium Neisseria gonorrhoeae
  - Transmitted between individuals by fluids and pus from infected mucous membranes
  - Can be spread from infected mother to her baby during pregnancy and delivery
  - Occurs in both men and women
  - Differs in course, severity, and ease of recognition

Gonorrhea

- Often treatable with antibiotics
  - Some strains resistant to usual antibiotic therapy
  - Immunization not available
  - Antibodies develop after exposure
    - Specific to strain that caused infection
    - Future reinfection with other strains can occur
Gonorrhea

- Affected areas of male anatomy
  - Urethra
  - Littre gland
  - Cowper gland
  - Prostate gland
  - Seminal vesicles
  - Epididymis

Gonorrhea

- Sudden onset of dysuria, urgency, and frequency seen several days after exposure
  - Associated urethral discharge rapidly becomes purulent and profuse
  - Direct spread of infection may result in
    - Prostatitis
    - Epididymitis
    - Seminal vesiculitis

Gonorrhea

- Primary gonorrheal infections may also affect
  - Pharynx
  - Conjunctivae
  - Anus
Gonorrhea

• Affected areas of female anatomy
  – Bartholin glands
  – Skene glands
  – Urethra
  – Cervix
  – Fallopian tubes

Gonorrhea

• More than 50 percent of infected women remain free of symptoms
  – Others have mucopurulent discharge that varies from scant to profuse
  – Contiguous spread may lead to
    • Endometritis
    • Salpingitis
    • Parametritis (pelvic inflammatory disease)
    • Tubo-ovarian abscesses
  – Complete or partial occlusion of fallopian tubes may result in sterility and increased risk for ectopic pregnancy

Gonorrhea

• Between 1 and 3 percent of gonococcal infections become disseminated in blood
  – Extension of disease may produce
    • Septicemia
    • Arthritis
    • Endocarditis
    • Meningitis
    • Skin lesions
Gonorrhea

- In bacteremic stage, patient may complain of fever, chills, and malaise
- Erythematous lesions are common, especially on extremities
  - May occur in clusters or singly

Chlamydia

- Major cause of sexually transmitted nonspecific urethritis (NSU) or nongonococcal genital infection
  - Disease is most common sexually transmitted disease in U.S.
    - Estimated 25 percent of men are carriers
    - Leading cause of preventable blindness
  - Signs and symptoms similar to those of gonorrhea
    - Makes differentiation difficult
    - No immunization available

Chlamydia

- In men, NSU may cause penile discharge
  - May cause complications
    - Swelling of testes, if untreated, may lead to infertility
- In women, NSU usually is symptomless
  - May cause vaginal discharge or pain with urination, salpingitis, and cervicitis
  - Transmission occurs secondary to direct contact with exudates, either sexually or during birth
- Treated with antibiotics
Herpes Virus Infections

- Four herpes viruses
  - Herpes simplex virus
  - CMV associated with mononucleosis, hepatitis, and severe systemic disease in immunosuppressed host
  - EBV causes mononucleosis
  - Varicella-zoster virus causes chickenpox and shingles

Herpes Simplex Virus

- Two antigenically distinct herpes simplex viruses responsible for STDs are herpes simplex virus 1 (HSV-1) and herpes simplex virus type 2 (HSV-2)
  - Both pathogens can cause herpes infection
  - Can cause infection anywhere in body
  - HSV-1 associated with herpes above waist
  - HSV-2 associated with genital herpes
    - Either type can cause disease in genital area
    - Immunization is not available for either
Herpes Simplex Virus

• Common in U.S.
  – Causes 300,000 to 500,000 new infections each year
  – About 42 million Americans thought to carry virus
  – 70 to 90 percent of adults have antibodies against HSV-1
• Mode of transmission
  • Skin-to-skin contact with infected area of body
  • Enters through break in skin or through mucous membranes
  • Sexual contact is not required for transmission
  • Touching herpes virus may result in finger infection (herpetic whitlow)

Herpes Simplex Virus

• Many young children who develop oral herpes (HSV-1) probably contract virus through casual kiss from a parent or relative
  – May be spread to other external body sites by autoinoculation (e.g., it may be spread from lip to finger to genitalia)

Herpes Simplex Virus

• Many young children who develop oral herpes (HSV-1) probably contract virus through casual kiss from a parent or relative
  – Initial HSV-1 transmission usually occurs by 4 years of age
    • Manifested by gingivostomatitis (“cold sores” or “fever blisters”)
  – Initial HSV-2 infection generally results from sexual activity
    • Manifested by painful vesicular lesions of cervix, vulva, penis, rectum, anus, mouth (depending on sexual practices)
Herpes Simplex Virus

- Once present in tissue, HSV produces acute infection, with tissue destruction limited to one site
  - Produces vesicular lesion (blister)
    - Heals spontaneously from outside in without lasting scarring
    - Virus remains alive in body despite circulating antibodies

- After primary infection, HSV enters CNS nearest site of initial infection
  - Travels along sensory nerve pathways to sensory nerve ganglion
  - Remains in latent stage until reactivated
  - When triggered by another infectious disease, menstruation, emotional stress, trauma, or immunosuppression, virus reaches epidermis by way of peripheral nerves
Herpes Simplex Virus

- After primary infection, HSV enters CNS nearest site of initial infection
  - Reproduces recurrent infectious disease state
    - Usually lasts 4 to 10 days
    - Lesions usually appear in area of initial inoculation
    - Number of lesions varies considerably

Why do you think the incidence of herpetic whitlow in health care workers has declined over the last 10 years?

Herpes Simplex Virus

- Can remain inactive for long time
- Unknown why many infected people never develop disease, others experience lifetime of periodic outbreaks
  - Antiviral agents such as acyclovir may shorten duration of outbreak
  - May be used as prophylactic agents in instances of frequent recurrence
Lice and Scabies

- Lice and scabies are potential health hazards for all health care providers
- Both can transmit communicable skin diseases and systemic illness, as well as dermatitis and discomfort

Lice

- Small, wingless insects that are ectoparasites of birds and mammals
- Most are host specific
- Two species are human parasites
  - Phthirus pubis, pubic, or crab louse
  - Pediculus humanus, which has 2 forms: Phthirus capitis (head louse) and Phthirus corporis (body louse)
- Have three-stage life cycle
  - Eggs hatch in 7 to 10 days
  - Nymph stage lasts 7 to 13 days
  - Egg-to-egg cycle lasts about 3 weeks
Lice

• Subsist on blood from host and have mouths modified for piercing and sucking
  – During biting and feeding, secretions from louse cause small, red macule and pruritus
  – Long infestation periods may result in decrease in pruritus and often thick, dry, scaly appearance to skin
  – In severe cases, oozing and crusting may be present

Lice

• If sensitization to louse saliva and feces occurs, inflammation may develop
  – Secondary infection may result from scratching of lesions
  – Lice spread through close personal contact, and sharing of clothing and bedding may result in outbreaks (e.g., at school, day care facilities, and in families)

Pubic Lice

• Have distinctive appearance, suggestive of miniature crabs
  – Gray-blue spots may be observed on abdomen and thighs of infested patients
  – Eggs (nits or ova) often are evident on shaft of pubic hairs
  – Sometimes seen in eyelashes, eyebrows, and axillary hairs
Pubic Lice

- Have distinctive appearance, suggestive of miniature crabs
  - Pubic lice usually are acquired during sexual activity or from unchanged bedding in which egg-infested pubic hairs have been shed
  - Although primary bite lesions seldom are evident, patient normally complains of intense pruritus and pubic scratching

Head Lice

- Have elongated body with head that is slightly narrower than thorax
  - Each louse has three pairs of legs, which possess delicate hooks at distal extremities
  - White ova of head lice (usually one nit to shaft) are easily mistaken for dandruff, but nits cannot be brushed out
- Most frequently affect children

Body Lice

- Slightly larger than head lice and concentrate around waist, shoulders, axillae, neck
  - Usually found in seams and on the fibers of clothing
  - Lesions from their bites begin as small, noninflammatory red spots
    - Quickly become papular wheals that resemble linear scratch marks
  - Head lice and body lice interbreed
Lice

- Treatment for all types of lice is designed to eradicate parasites and nits and to prevent reinfection
  - Patients advised to wash all clothing, bedding, and personal articles thoroughly in hot water
  - Wash infected body area with
    - Gamma benzene hexa-chloride shampoo (Kwell)
    - Crotamiton (Eurax)
    - Rid
    - Nix
    - Overtreatment should be avoided to prevent toxicity

Scabies

- Human scabies mite (Sarcoptes scabiei var. hominis) is parasite
  - Completes its entire life cycle in and on epidermis of its host
  - Infestation resembles lice infestation
    - Scabies bites generally concentrated around hands and feet, especially in webs of fingers and toes
Scabies

• Other common infestation areas
  – Face and scalp of children
  – Nipples in females
  – Penis in males

• Scabies mite usually passed by intimate contact or acquired from infested bedding, furniture, and clothing
  – Can burrow into skin within minutes

Scabies

• Infestation often manifested by severe nocturnal pruritus
  – Takes 4 to 6 weeks for sensitization to develop and itching to begin
  – Adult female mite is responsible for symptoms
    • After impregnation, burrows into epidermis to lay eggs
    • Remains in burrow for life span of about 1 month

Scabies

• Although vesicles and papules form at surface, often are disguised by results of scratching
• In severe cases (e.g., Norwegian scabies), oozing, crusting, and secondary infection may result
• Susceptibility is general
  – People with previous exposure usually develop fewer mites on later exposures and experience symptoms earlier (within 1 to 4 days)
Scabies

• Treatment similar to that for lice infestation
• Symptoms may persist for longer than 1 month until mite and mite products are shed with epidermis
  – Mites are communicable until all mites and eggs have been destroyed
  – Reinfestation is common, patient should be reexamined if itching has not abated after several weeks
  – Antibiotic therapy may be needed to treat secondary bacterial infection
  – Immunization is not available

Reporting an Exposure

• Exposure incident (significant exposure)
  – Any specific contact of eyes, mouth, mucous membranes, nonintact skin, parenteral contact, with
    • Blood
    • Blood products
    • Bloody body fluids
    • Other potentially infectious materials
  – Exposures and all suspected exposures to infectious or communicable disease must be reported to DO

Reporting an Exposure

• Reporting exposure important for following reasons
  – Permits immediate medical follow-up
  – Allows identification of infection and immediate intervention
  – Enables DO to evaluate circumstances of incident
  – Allows DO to determine what changes to make to prevent future exposures
  – It aids follow-up testing of the source person if permission for testing can be obtained
  – Ensures if health care worker is infected, has been documented disease occurred from work-related exposure
Submitting the Report

• Ryan White Act requires employers to appoint someone in organization to whom exposed employee can report
  – Officer follows exposure control plan
    • Plan must comply with standards and guidelines relative to exposure and must meet any local reporting requirements

Medical Evaluation and Follow-Up

• By law, employers must provide free medical evaluation and treatment to exposed employees
  – Counseling regarding risks, signs and symptoms, probability of developing clinical disease, and how to prevent future spread of potential infection
  – Appropriate treatment in line with current U.S. Public Health Service recommendations
  – Discussion of medications offered and their side effects and contraindications
  – Evaluation of any reported illness to determine whether symptoms are related to HIV or hepatitis

Steps Involved

• Blood tests of exposed employees are always contingent on employee agreement
  – Employees have option to provide blood samples
  – Can refuse permission for HIV testing at time sample is drawn
  – Employer must maintain blood samples for 90 days in case employees change their mind regarding testing if HIV- or hepatitis-like symptoms develop
How do you think you would feel if you were stuck by a contaminated needle and the patient refused HIV testing?

Steps Involved

- As agent of employer, health care worker must take following steps
  - Provide counseling to employee based on test results
  - Provide informed consent regarding prophylaxis and therapeutic regimens
  - Implement regimens after receiving approval from employee
  - Vaccines also should be made available to all employees who are exposed to blood and other potentially infectious materials during their work

Written Report and Confidentiality

- Agent of employer will send written report to DO of employer
  - States whether vaccination was offered to exposed employee
  - States whether employee received it
  - Must note that employee was informed of results of evaluation and told of any medical conditions resulting from exposure that may require further evaluation or treatment
  - Copy of report must be provided to employee and to DO for agency’s files
Written Report and Confidentiality

- All other elements of employee’s medical record are confidential
  - Cannot be supplied to employer
  - Employee must give written consent for anyone to view records
    - Records must be maintained for duration of employment plus 30 years
    - Complies with OSHA standards regarding access to employee exposure and medical records

Paramedic Role in Preventing Disease Transmission

- Health care worker should not go to work if following conditions present
  - Fever
  - Diarrhea
  - Draining wound or any type of wet lesion
  - Jaundice
  - Mononucleosis

- Treatment with a medication and/or shampoo for lice or scabies
- Strep throat (unless antibiotics have been taken for longer than 24 hours)
- Cold with productive cough (unless paramedic wears surgical mask)
Have you come to school or work with any of these conditions?

Other Disease Prevention Considerations

• Always approach scene with caution
  – Uncontrolled scene increases likelihood of transmission of body fluids

Other Disease Prevention Considerations

• Universal precautions should be observed at all times
  – Gloves
  – Protective eyewear
  – Face shield
  – Gown
  – Appropriate particulate mask when airborne disease is suspected
• Universal precautions are based on premise that all body fluids, in any situation, may be infectious
Other Disease Prevention Considerations

• Immediately suspect infectious disease
  – Cough
  – Headache
  – General weakness
  – Recent weight loss
  – Nuchal rigidity
  – High fever

Other Disease Prevention Considerations

• Always
  – Provide same level of care to all patients
  – Disinfect equipment and patient compartment with proper disinfectant solution
  – Practice effective hand washing
  – Report any infectious exposure to agency’s DO

Imagine that you are on a call and get a small splash of blood in your eyes. What do you think would prevent you from reporting it immediately so that your postexposure care could begin?
Summary

• National concerns about communicable disease and infection control have resulted in public law, standards, guidelines, and recommendations to protect health care providers and emergency responders against infectious diseases
  – Paramedics must be familiar with these guidelines
  – Must take personal protective measures against exposure to these pathogens

Summary

• Chain of elements needed to transmit an infectious disease includes
  – Pathogenic agent
  – Reservoir
  – Portal of exit from the reservoir
  – Environment conducive to transmission of pathogenic agent
  – Portal of entry into new host
  – Susceptibility of new host to infectious disease

Summary

• Human body is protected from infectious disease by external and internal barriers
  – Serve as lines of defense against infection
  – External barriers
    • Skin
    • GI system
    • Upper respiratory tract
    • Genitourinary tract
  – Internal barriers
    • Inflammatory response
    • Immune response
Summary

• Progression of infectious disease from exposure to onset of symptoms follows four stages
  – Latent period
  – Incubation period
  – Communicability period
  – Disease period

Summary

• HIV is directly transmitted person to person
  – Occurs through anal or vaginal intercourse, across placenta, by contact with infected blood or body fluids on mucous membranes or open wounds, through blood transfusion or tissue transplant, or by use of contaminated needles or syringes
  – Affects CD4 T cells
  – Secondary complications are usually related to opportunistic infections that arise as the immune system deteriorates

Summary

• HIV
  – Progression of disease can be divided into
    • Category A (acute retroviral infection, seroconversion, and asymptomatic infection)
    • Category B (early symptomatic HIV)
    • Category C (late symptomatic HIV and advanced HIV)
  – Paramedics should observe strict compliance with universal precautions for protection against HIV
  – Patient care should include helping these patients feel that they can obtain acceptance and compassion from health care workers
Summary

• Hepatitis is a viral disease
  – Produces pathologic changes in the liver
  – Three main classes of hepatitis virus
    • Hepatitis A
    • Hepatitis B
    • Hepatitis C
  – Infection with hepatitis may cause mild symptoms, liver failure, or death

Summary

• Tuberculosis is a chronic pulmonary disease
  – Acquired through inhalation of tubercle bacilli
  – Infection is passed mainly when infected people cough or sneeze bacteria into the air or by contact with sputum that contains virulent TB bacilli
  – Infection is characterized by stages of early infection (frequently asymptomatic), latency, and a potential for recurrent postprimary disease

Summary

• Meningococcal meningitis is an inflammation of membranes that surround the spinal cord and brain
  – Can be caused by bacteria, viruses, and other microorganisms
• Bacterial endocarditis is inflammation of the endocardium on any one or more heart valves
  – Can be rapidly fatal if left untreated
Summary

• Pneumonia is an acute inflammatory process of respiratory bronchioles and alveoli
  – Bacteria, viruses, and fungi can cause this disease
• Tetanus is a serious, sometimes fatal, disease of the CNS
  – Caused by infection of a wound with spores of the bacterium C. tetani
  – Most common symptom is trismus (difficulty opening the mouth)

Summary

• Rabies is an acute viral infection of the CNS
  – Humans are highly susceptible to the rabies virus after exposure to saliva from the bite or scratch of an infected animal
• Hanta viruses are carried by rodents
  – Transmitted through inhalation of material contaminated with rodent urine and feces
  – Many forms of this disease occur in specific geographical areas

Summary

• Rubella is a mild, febrile, highly communicable viral disease
  – Characterized by a diffuse, punctate, macular rash
  – CDC recommends that all health care providers receive immunization if they are not immune as a result of previous rubella infection
• Rubeola is an acute, highly communicable viral disease caused by the measles virus
  – Characterized by fever, conjunctivitis, cough, bronchitis, and a blotchy red rash
Summary

• Mumps is an acute, communicable systemic viral disease
  – Characterized by localized unilateral or bilateral edema of one or more of the salivary glands
  – Occasionally other glands are also involved

Summary

• Chickenpox is highly communicable
  – Characterized by a sudden onset of low-grade fever, mild malaise, and a maculopapular skin eruption that lasts for a few hours
  – Followed by a vesicular eruption that lasts for 3 to 4 days, leaving a granular scab
  – Virus may reactivate during periods of stress or immunosuppression
  – At that time, it may cause an illness known as shingles

Summary

• Pertussis is an infectious disease that leads to inflammation of entire respiratory tract
  – Causes an insidious cough, which becomes paroxysmal in 1 to 2 weeks and lasts 1 to 2 months
• Influenza is mainly a respiratory infection, and spread by influenza viruses A, B, and C
Summary

- Mononucleosis is caused either by the Epstein-Barr virus or by cytomegalovirus
  - Both of these are members of the herpes virus family
- Syphilis is a systemic disease
  - Characterized by a primary lesion; a secondary eruption involving skin and mucous membranes; long latency periods; and eventually by seriously disabling lesions of the skin, bone, viscera, CNS, and cardiovascular system

Summary

- Gonorrhea is caused by the sexually transmitted bacterium N. gonorrhoea
  - Can be treated with antibiotics
  - Some strains brought into the U.S. from other countries do not respond to usual antibiotic therapy

Summary

- Chlamydia is a major cause of sexually transmitted nonspecific urethritis or genital infection
  - Signs and symptoms are similar to those of gonorrhea
- Herpes simplex virus is transmitted by skin-to-skin contact with an infected area of the body
  - Primary infection produces a vesicular lesion (blister)
  - Lesion heals spontaneously
  - After primary infection, virus travels to sensory nerve ganglion, remains there in latent stage until reactivated
Summary

• Lice are small, wingless insects that are ectoparasites of birds and mammals
  – During biting and feeding, lice secrete a substance that causes small red macules and pruritus
• Human scabies mite is a parasite
  – Completes its life cycle in and on the epidermis of host
  – Scabies bites are usually concentrated around hands and feet, especially in webs of the fingers and toes

Summary

• Reporting a possible communicable disease exposure permits immediate medical follow-up
  – Enables DO to make changes that might prevent exposures in the future
  – Helps employees to obtain proper evaluation and testing
• Part of paramedic's professional duty with regard to infectious disease transmission is to know when not to go to work
  – Paramedics also have duty to use proper BSI precautions at all times

Questions?