Altered Immune Response
HIV/AIDS

Associate Degree Nursing Program
Napa Valley College

Immunity

- State of responsiveness to foreign substances
- Serves 3 functions
  - Defense
  - Homeostasis
  - Surveillance

Properties of the Immune Response

- Specificity
- Memory
- Self-recognition
- Self-limitation
- Specialization
Lymphoid organs

- Function in production of lymphocytes, one of the essential cells of the immune response.
- System composed of
  - Central (primary) organs: thymus gland and bone marrow.
  - Peripheral organs: tonsils, gut, genital, bronchial, and skin-associated lymphoid tissues, lymph nodes, and spleen.

Lymphoid organs (continued)

- Antigen introduced into body are carried by the bloodstream or lymph channels to regional lymph nodes. The antigens then interact with B and T lymphocytes and macrophages in the lymph node.
- 2 important functions of the lymph nodes are
  1. Filtration of foreign material brought to the site and
  2. Circulation of lymphocytes
- Spleen: primary site of immune responses to blood-borne antigens. If spleen is removed it can predispose one to life-threatening septicemia.

Lymphoid organs (continued)

- Lymphocytes are produced in the bone marrow and migrate to the peripheral organs.
- Thymus is important in differentiation and maturation of T lymphocytes and is essential for a cell-mediated response. Gland decreases with age.
T lymphocytes (thymus dependent cells)

- T cells compose 70%-80% of circulating lymphocytes and are primarily responsible for immunity to intracellular viruses, tumor cells and fungi. T cells live form a few months to the life span of an individual and account for long-term immunity.

Cell-mediated immunity

- Cells involved are:
  - T lymphocytes
  - Macrophages
  - Natural killer cells

- Cell mediated immunity of importance in:
  - Viruses, bacteria
  - Fungal infections
  - Rejection of transplanted tissues
  - Contact hypersensitivity reactions
  - Tumor immunity

T lymphocytes

- Catagorized as:
  - T-cytotoxic-attack antigens of foreign pathogens and some remain as memory cells.
  - T-helper (CD4)
  - T-suppressor (CD8)
Natural killer cells
- Recognition and killing of virus-infected cells, tumor cells and transplanted grafts.

Cytokines
- Immune response involves interaction between T cells, B cells, monocytes and neutrophils.
- Cytokines are soluble factors secreted by cells acting as messengers between cells. They instruct the cells to alter activity.
- 60 different types, including interferon

Humoral Immunity
- Antibody-mediated immunity
  - Antibodies are proteins produced by B cells and found in plasma, therefore the term "humoral" (which means fluid) immunity is used
  - Antibodies are immunoglobulins. Immunoglobulins are composed of amino acids arranged on polypeptide chains. Differences in the chain configuration differentiate the five classes of immunoglobulins; IgG, IgA, IgM, IgD, IgE
Pediatric humoral immunity

- IgG crosses placental membrane to provide passive acquired immunity for 3 months. Breast milk can provide passive immunity from IgA.

Adult Humoral Immunity

- Involves B Lymphocytes
- Product: antibody
- Protects against:
  - a. bacteria
  - b. extracellular viruses
  - c. resp and gastro pathogens
- Plays a role in anaphylactic shock, atopic diseases, transfusion reactions and bacterial infections.

Altered immune response

- Hypersensitivity reactions-immune system overreactive against foreign antigens or fails to maintain self-tolerance and results in tissue damage.
Anaphylaxis

- Anaphylactic reactions occur suddenly in hypersensitive patients after exposure to an offending allergen.
- May occur following parenteral injection of drugs (antibiotic), blood products and insect stings.

Anaphylaxis (continued)

- Cardinal principle of intervention is speed in:
  1. Recognition of signs and symptoms
  2. Maintenance of patent airway
  3. Prevention of spread of allergen by use of tourniquet
  4. Administration of drugs
  5. Treatment for shock

New Technologies in Immunology

Cell fusion techniques and standard in vitro tissue culture to produce hybrid cells which are then injected into an individuals blood.

Types:
- monoclonal antibodies
- recombinant DNA
- gene therapy
- polymerase chain reaction
Human Immunodeficiency Virus Infection (HIV)

History of HIV/AIDS

- 1981 first year that health care workers documented the presence of a new disease
- 1985 causative agent identified as HIV, antibody test developed and routes of transmission determined
- 1987 drug therapy established to treat infection

HIV trends and statistics

Future and current impacts to society and health care

- Global statistics
  - 29 million HIV infected people worldwide
  - 8500 people become infected with HIV daily
  - By the year 2006, 1.7 million people will die from the disease
  - 650,000-900,000 people in the U.S. are infected with HIV
  - Some experts claim that the fastest growing groups of people are women and adolescents
HIV trends

- 10% of people with AIDS in the U.S. are 50 years of age or older
- Every year, 44,000 more Americans are infected with HIV
- Women are 8 times more likely than men to contract HIV from one act of intercourse.

Transmission of HIV

- Virus can be transmitted through
  - Body fluids, including blood, semen, vaginal secretions, and breast milk
  - Transmissions has occurred via sexual intercourse with an infected partner, internalized exposure to HIV infected blood or blood products and perinatal transmission during pregnancy, during birth and through breastfeeding

Transmission

- HIV can be transmitted to others within a few days after initial infection, after that, transmission is lifelong.
- HIV cannot be transmitted by casual contact such as hugging, dry kissing, sharing eating utensils nor have any cases been documented of transmission from tears, saliva, urine, emesis, sputum, feces or sweat.
- There is no evidence that the virus can be transmitted by insects
Sexual Transmission
Sexual contact with HIV infected partner is most common method of transmission. Men who have sex with men (MSM) were initially the largest aggregate of HIV cases, heterosexual intercourse is the fastest-growing mode of HIV transmission in the U.S. and the dominant mode of HIV transmission worldwide.

Sexual transmission
- During sexual intercourse (anal, vaginal or oral), the risk of infection is considerably greater for the partner who receives the semen, although infection also can be transmitted to an inserting partner (more prolonged exposure to semen).
- Sexual activities that involve blood, such as during menstruation or as a result of trauma to tissue increases the risk of transmission.

Variables of Transmission
- Viral load
- Amount of exposure
- Frequency of exposure
- Duration of exposure
- Virulence of organism
- Immune function of host
Contact with Blood products

- HIV is transmitted by exposure to contaminated blood through the accidental or intended sharing of injection equipment. (IV drug use and “sharps” incidents).
- As of 2001, occupational exposure to HIV has resulted in 57 documented cases of HIV seroconversion among health care personnel, of these 30% were nurses.

Perinatal Transmission

- Transmission from an HIV infected mother to her infant can occur during pregnancy, delivery or through breastfeeding. 14-45% of infants born to HIV infected women will be born with HIV.
- Among children with AIDS in the U.S., 91% were infected at birth. AIDS is now among the top 10 leading causes of death among children aged 1 to 4.

Pathophysiology of HIV/AIDS

- HIV is RNA virus. RNA are called “retrovirus” because they replicate in a backward manner (going from RNA to DNA)
- Like all viruses, it can’t replicate unless inside a living cell
Pathophysiology

- Genetic material of HIV virus binds to CD4 receptor site on cell.
- Mechanisms used by HIV to replicate via enzymes:
  - Reverse transcriptase
  - Integrase
  - Protease

Pathophysiology

- Initial infection with HIV results in viremia, when large amounts of the virus can be isolated in the blood.
- Followed by prolonged period (up to 12 years) when there may be few clinical symptoms.
- During early asymptomatic infectious stage, a steady state of viral load is maintained by rapid and constant HIV replication

Immune response to pathology

- Foreign antigens interact with B cells and initiate antibody development, and with T cells to initiate a cellular immune response. Immune response is initially able to effectively reduce viral load.
- Immune dysfunction in HIV disease is caused predominantly by the dysregulation and destruction of CD4 T cells (also known as T helper cells)
CD4 T cell immune function

- Adults normally have 800-1200 CD4 T cells per ul of blood, normal lifespan is ~100 days. HIV infected cells die after only 2 days.
- Eventually the ability of HIV to destroy CD4 T cells exceeds the body’s ability to replace which results in a decline in CD4 T cell count.
- Immune system can remain healthy with CD4 T cell count >500 ul.

CD4 T cells

- Immune problems start to occur when count drops to 200-499 CD4 T Cells/ul.
- Severe problems (such as infections and cancers) develop if count drops below 200 ul.
- The diagnosis of AIDS can be made when an individual with HIV develops a CD4 T cell count <200/ul.

Clinical symptoms

- Acute Retroviral Syndrome
- Development of HIV specific antibodies (seroconversion) is often accompanied by flu-like symptoms of fever, night sweats, headache, malaise, rash, diarrhea which may last 1-3 weeks after initial infection.
Clinical symptoms

- Early infection - median interval between HIV and diagnosis of AIDS is ~10 years.
- Phase is termed “asymptomatic disease”.
- Many people are unaware that they are infected and continue high risk activities and have the ability to transmit virus to others.

Clinical symptoms

- Early Symptomatic disease - diarrhea, headaches, night sweats, fatigue. CD4 T cell count below 500/ul.
- Most common infection with early symptomatic HIV is oropharyngeal candidiasis or thrush.
- Other infections include; shingles, vaginal candida, herpes, oral hairy leukoplakia on tongue.

Clinical early symptoms

- Neurological manifestations
  - Headache, aseptic meningitis, cranial palsy, neuropathies.
Diagnosis of AIDS

- HIV infected individual must meet criteria established by CDC r/t opportunistic diseases and CD+4 lymphocyte count.
- Median time for survival after diagnosis of AIDS is 2 years but varies greatly.
- Wide variation in morbidity
- Multiple opportunistic diseases can occur at the same time

Common opportunistic diseases associated with AIDS

- Pneumocystis carinii pneumonia (PCP)
- Mycobacterium Tuberculosis
- Kaposi’s sarcoma (KS)
- Herpes
- Cytomegalovirus retinitis (CMV)
- Candida Albicans
- Non-Hodgkin’s lymphoma
- AIDS-dementia complex (ADC)
- Varicella zoster virus (VZV)

Kaposis Sarcoma
Diagnostic Studies for diagnosis of HIV/AIDS

- Delay of 2 months after infection before detectable HIV antibodies are produced, (therefore individual will not test positive)
- HIV testing problematic on newborns as all infants born to HIV infected mothers will be positive on HIV antibody test due to maternal antibodies.

Diagnostic testing/newborns

- Maternal HIV antibodies can be present until 18 months.
- Must use HIV antigen test, polymerase chain reaction (PCR) or viral culture to definitively diagnose HIV in infants by age of 4 weeks.

Lab tests

- Progression of HIV infection: monitored by CD4 T cells as marker for decreased immune function; Viral Load
- Further tests
  - PCR
  - bDNA
  - WBC
- CBC
- HIV RNA level
- ELIZA
- Western Blot
- PCR
- Pediatric monitoring: viral load (not antibody detection)
Drug Therapy for HIV infection

- Goals for therapy
  - Decrease HIV RNA levels
  - Maintain or raise CD4 T cell count to >500 ul
  - Delay development of HIV related symptoms, including wide range of opportunistic diseases

Drug therapy for HIV infection

- Use of antiretroviral therapy
- Strict adherence to treatment protocols is extremely important to prevent resistant strains and to maintain therapeutic levels.
- Women should receive antiretroviral therapy regardless of pregnancy status

Nursing Management

- Assessment- focus on those individuals not known to be infected with HIV should be on prevention/education
- HIV + individuals need assessment of subjective and objective data.
- Multiple nursing diagnosis
Nursing Diagnosis
- Body image disturbance
- Fear, powerlessness
- Social isolation
- Risk for infection
- Altered sexual patterns
- Continue to name as many as you can think of

Nursing interventions
- Health promotion
- Prevention of HIV
- Education (including resources)
- Emotional and psychological support
- Monitoring of symptoms and disease progression

Preventing occupational exposure
- Use of precautions
  - Use of barriers
  - Careful handling and disposal of sharps
  - Education and awareness
  - PEP (post exposure prophylaxis)
HIV/AIDS: Factors to be Considered:
- Caring for individuals in a non-discriminatory manner
- Obligation to care
- Beliefs, Values, Attitudes

Providing Physical and Emotional Support
- Hospital vs ambulatory/home care
- Hospice care
- Community resources
- Assistance with adherence

Legal/Ethical Issues
- Confidentiality/Reporting
- Obligation to care
- Discrimination
- Personal responsibility
- Mandatory HIV Testing
- Political issues ie/needle exchange programs
Awareness and Recognition Discussion

- AIDS Memorial Quilt
- World AIDS Day
- Newest Trends and Advances