Immune & Lymph Systems Pathophysiology

14 C
Pathophysiology

• When immune system malfunctions, it can unleash many disorders and diseases

• **Autoantibodies** contribute to many diseases
  – T Cells can attack own pancreas and cause diabetes
  – The rheumatoid factor autoantibody can cause Rheumatoid arthritis
Pathophysiology

- When the immune system lacks one or more of its components, an **immunodeficiency** disorder occurs
  - Can be acquired through:
    - Infection
    - Inherited
      - Body fails to recognize “self” and destroys own tissues
    - **Regulatory T Cell** malfunction
      - T Cells fail to “turn off” an immune response
    - **Side effect of drugs**
      - Chemotherapy
      - Antirejection drugs for transplants
Autoimmune Disorders

• Run in families, such as lupus and multiple sclerosis
• Some caused by environmental exposures
  – Sunlight
  – Chemicals
  – Viral & bacterial infections
• Some R/T race or ethnic background
  – Type 1 Diabetes, Caucasian
  – Lupus, African & Hispanic
Autoimmune Disorders

• **80** different types of autoimmune disorders

• **Are there medicines to treat autoimmune diseases?**
  
  – **Drugs** can help **relieve some symptoms** such as:
    • pain, swelling, depression, anxiety, sleep problems, fatigue, or rashes
  
  – **Hormone Replacement therapy**
    • Insulin
    • Thyroid hormone replacement
  
  – **Suppress** the immune system
    • Immunosuppressant drugs
    • Low-dose chemotherapy (methotrexate for rheumatoid arthritis)
    • Anti-rejection drugs (for transplant recipients)
    • Anti-TNF drugs (block some inflammation [arthritis, psoriasis])
HIV/AIDS

- Acquired Immune Deficiency Syndrome (AIDS)
  - caused by infection with Human Immunodeficiency Virus (HIV)

- AIDS
  - severely decreased immune function d/t HIV virus
    - Uses host cells (DNA) to replicate itself
    - Invades and kills helper T cells and macrophages
    - Destroys lymph nodes d/t chronic infections
    - Decreases immune enhancing chemicals
HIV/AIDS

- Etiology: exposure to infected body fluids
  - Sexual contact
  - IV drug use
  - Consumption of breast milk
  - Development of fetus in HIV-infected mother
  - Accidental exposure to infected body fluids (rare)
  - Blood transfusion if donor was HIV infected (also rare in US today because of intense screening procedures)
HIV/AIDS

• Signs & Symptoms:
  – Approximately 4 weeks after HIV infection, patients develop flu-like symptoms as body makes first attempt to fight off virus
  – Immune system may continue to fight off disease for next 10-12 years without any obvious symptoms
  – Eventually, disease progresses to full-blown AIDS:
    • Opportunistic infections
    • CNS dysfunction
    • Some forms of cancer (Kaposi’s Sarcoma)
HIV/AIDS

• Diagnostic tests:
  – H&P
  – Low helper T-cell count

• Treatment:
  – antiviral drugs block viral reproduction & block entrance of virus into cells
    • Drug regimens are
      – Complicated
      – Have severe side effects
      – Are usually effective at postponing full-blown AIDS
Persons Living with an HIV Diagnosis / 2008

# of Cases, by County, Overall

2008 Count of adults/adolescents living with an HIV diagnosis:
- 160+
- 54 to 159
- 24 to 53
- 12 to 23
- 0 to 11
- Data not shown *
- Data not available **
- No counties in this jurisdiction
Allergies/Hypersensitivity Reactions

- **Etiology:** immune system mounts *overactive response* to foreign antigen
  - treats harmless antigen like invading pathogen
  - mast cells stimulated, histamine released

- **Signs & Symptoms:**
  - red, runny eyes
  - runny nose (allergic rhinitis)
  - allergic asthma
  - contact dermatitis
Allergies/Hypersensitivity Reactions

• Diagnostic tests:
  – H & P
  – Allergy skin testing

• Treatment:
  – Tx sxs
  – Antihistamines
  – Bronchial dilators
  – Allergy shots
  – Avoid allergens
Histamine

• Is a cytokine
  – Attracts WBCs to area of allergic reaction
    • Clear dead cells and pathogens away
    • Increases capillary permeability
      – Fluid leaks
      – Swelling
      – Increases pressure in tissue, causes pain
      – More blood to area increases temperature of tissue
Anaphylaxis

• Severe allergic reaction
  – Systemic inflammation
    • Abdominal pain, vomiting
    • Tachycardia
    • Itching
  – Decreased BP d/t vasodilation
  – Throat can swell shut
    • Difficulty breathing, hoarseness, wheezing, coughing
  – Can be fatal
  – Tx:
    • Epi-pen (decreases swelling, increases BP)
    • Antihistamines
    • Steroids
    • Analgesics
Hodgkin’s Lymphoma

– Etiology: uncontrolled proliferation of lymphocytes (30 different types) - cancer of the lymphatic system

– Signs and symptoms:
  • Painless enlarged lymph nodes
  • Reed-Sternberg cells are only in this type of lymphoma
  • Fever
  • Weight loss
  • Weakness
  • Fatigue
  • Itching
Hodgkin’s Lymphoma

• Diagnostic tests:
  – H & P
  – Biopsy
  – Imaging
  – Bone marrow tests

• Treatment:
  – Chemotherapy
  – Radiation
  – Antibody therapy
  – Stem cell or bone marrow transplant
Splenomegaly

• Etiology: Infections, liver disease, cancer, blood diseases

• S/Sxs:
  – Hiccups
  – Inability to eat a large meal
  – Pain on the upper left side of the abdomen

• Diagnostic Tests:
  – X-ray, ultrasound, or CT scan
  – Blood tests: CBC and liver function tests

• Tx:
  – Tx underlying cause, avoid contact that might cause the spleen to rupture (no sports or activities that could cause bumping into the spleen) that could be life-threatening
Tonsillitis

• Etiology: **viral** or **bacterial**
• S & Sxs: sore throat, swollen tonsils, dysphagia
• Diagnostic tests: H & P, culture
• Tx: **antibiotics** for bacterial, warm throat irrigations, possible surgery
Immunity and Cancer

- Cancer/Malignant cells
  - Etiology: Uncontrolled growth of cells
    - Some of their surface antigens change
    - Immune system cells are constantly patrolling and working to eliminate changed, malignant cells
    - When surveillance breaks down or immune system overwhelmed, cancer can result
  - There are more than 100 types of cancer
  - S/Sxs: usually no sxs and painless initially
  - Diagnostic tests: varies with sxs, type/location of cancer
  - Tx: vary with type; maybe chemotherapy, radiation, bone marrow or stem cell transplant
Immunity and Cancer

- Antibody
- Cancer cell
- Natural killer cell
- Helper T cell
- Macrophage
- Cytotoxic T cell

Leukemia

• Etiology: excess production of WBCs, causes decreased function of WBCs; Crowds out RBCs and platelets

• Signs and symptoms:
  – Infections
  – SOB
  – Anemia
  – Bleeding and bruising
  – Fatigue
  – Weight loss
Leukemia

• Diagnostic tests:
  – H & P
  – CBC
  – Bone marrow biopsy

• Treatment depends on type:
  – Chemotherapy
  – Stem cells
  – Bone marrow transplant
    • From donor
    • Autologous
Leukemia

• Cancer of **bone marrow and blood**
• Characterized by overproduction of **WBCs**
• In some forms these cells are immature or non-functional
• Types of leukemia:
  – Acute myelogenous
  – Chronic myelogenous
  – Acute lymphocytic
  – Chronic lymphocytic
Types of Leukemia

- **Myelogenous leukemia**: cells that divide out of control are *blood stem cells*
- **Lymphocytic leukemia**: cells that divide out of control are *lymphocytes*
- **Acute leukemias**: have *rapid onset* of symptoms; overproduced *WBCs* are *immature*, non-functional cells
- **Chronic leukemias**: have *gradual onset*; overproduced *WBCs* are *mature*, functional cells
Cancer cells can spread around body via lymphatic system

Degree of spreading can be used to predict patient’s prognosis

Cancers that have already spread at time of diagnosis are much more likely to be fatal

Earlier a patient with cancer is diagnosed, better chances are of beating disease
Cancer Staging for Tumors

- Stage 0, cancer *confined* to inner layer of tissue only
- Stage I, cancer has *penetrated several layers* of colon or rectal wall
- Stage II, cancer has *penetrated most of wall*, may extend to nearby tissue, *angiogenesis* to tumor
- Stage III, cancer *penetrated entire wall*, spread to lymph nodes
- Stage IV, cancer spread (*metastasized*) to other organs (usually liver or lungs)

Example:
Colo-rectal Cancer
Leukemia Cancer Staging

• Leukemias are categorized more based on treatment
  – Treated
  – Untreated
  – In remission
  – Recurrent