IMMUNE SYSTEM

IMMUNOSUPPRESSANT DRUGS
IMMUNIZING DRUGS
AND
HIV

1

IMMUNITY

- Natural immunity or Innate- nonspecific response to any foreign invader
  - White blood cell action: release cell mediators such as histamine, bradykinin, and prostaglandins and engulf (phagocytize) foreign substances
  - Inflammatory response
  - Physical barriers, such as intact skin, chemical barriers, and acidic gastric secretions or enzymes in tars and saliva
- Acquired immunity: specific against a foreign antigen
  - Result of prior exposure to an antigen
  - Active or passive

2

ACTIVE AND PASSIVE IMMUNITY

- Active
  - Immunologic defenses developed by person's own body
  - Lasts many years; may last a lifetime
- Passive
  - Temporary
  - Results from transfer of a source outside of the body that has developed immunity through previous disease or immunization
  - For example, transfer of antibodies from mother to infant through breast feeding; receiving immune globulin through injections

3

ACTIVE (NATURAL OR ARTIFICIAL)? PASSIVE (NATURAL OR ARTIFICIAL)?

- Receiving a varicella vaccine
- Having chicken pox as a child and not getting the disease later in life if exposed to it
- Giving an antiven drug if a person was bitten by a snake
- Antibodies pass from mom to infant during breast feeding or pregnancy

4

IMMUNE SYSTEM

- The purpose of the *immune system* is to distinguish self from nonself and to protect the body from foreign material (antigens), including cancer.
- Two types of immunity: humoral immunity, which is mediated by B lymphocytes, and cellular immunity, which is mediated by T lymphocytes

5

FUNCTION OF THE IMMUNE SYSTEM

- To remove foreign antigens such as viruses and bacteria to maintain homeostasis
- Phagocytosis: monocytes responsible for engulfing and destroying foreign bodies and toxins
- Inflammatory response:
  - Response to injury or invading organisms
  - Chemical mediators minimize blood loss, wall off invading organisms, activate phagocytes, promote formation of scar tissue and regeneration of injured tissue

6

IMMUNE SYSTEM (CONT.)

- Participates in anaphylactic reactions
- Responsible for rejection of kidney, liver, and heart transplants
- Can also sometimes attack itself, causing "autoimmune diseases" or immune-mediated diseases

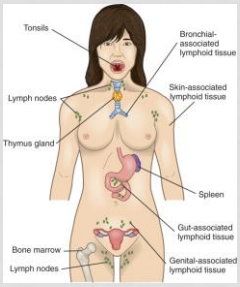
7

WHAT ORGANS ARE INVOLVED IN THE IMMUNE SYSTEM?

- Central Lymphoid organs
- Peripheral Lymphoid organs

8

ORGANS OF IMMUNE SYSTEM



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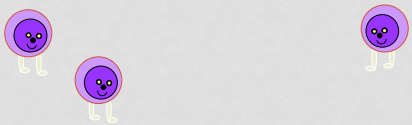
TYPES OF LYMPHOCYTES

T cells	70%–80%
B cells	10%–20%
Natural killer (NK) cells	<10%



10

B LYMPHOCYTES/ HUMORAL IMMUNITY

- **Humoral Immunity-** involves interaction between antigen and antibody
- **Antigens-** particles recognized as foreign that elicit the binding of antibodies.
- **Antibodies-** Protein molecules that attach to the surface of antigens. Antibodies are also called immunoglobulins.

11

B CELL FUNCTION

- Mature in the **bone marrow**
- Life span is short
- B cells have binding sites that are specific to a pathogen
- When the antigen is present it binds to the receptor on the B cell. This triggers the B cell to grow and clone itself. The clones become either plasma cells or memory cells.
- **Plasma cells** generate massive amounts of antibodies and release them into the body.
- The antibody binds to the antigen signaling the cells to kill the pathogen,
- **Memory cells** do not secrete antibodies. They help the body mount a faster and stronger attack the next time the antigen invades.

12

HUMORAL IMMUNE RESPONSE

- Antibodies
  - Immunoglobulins: IgA, IgD, IgE, IgG, IgM
  - Defend against foreign invaders
  - Agglutination, opsonization
- Antigen–antibody binding
  - Antigenic determinant

13

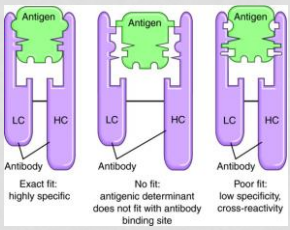
AUDIENCE RESPONSE QUESTION

A patient with a sore throat and rhinitis has an elevated level of IgG in the blood. The nurse explains that the patient's symptoms are *most* likely caused by

a. an allergy.
b. exposure to toxic fume.
c. an initial viral infection.
d. a re-infection by bacteria.

14

ANTIGEN–ANTIBODY BINDING



15

T CELL LYMPHOCYTE /CELL-MEDIATED IMMUNITY

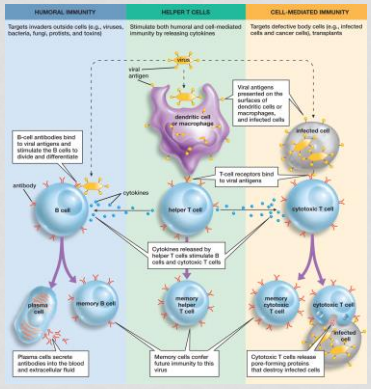
- T cells differentiate in the **thymus gland**
- Life-span is long
- T cells are required to search out foreign invaders and identify them for destruction.
- **Helper T cells** (exhibit the CD4 glycoprotein)- release **cytokines** (such as **interferons and interleukins**) that boost the person's immune system by signaling growth, differentiation and enhance the action of other immune cells like macrophages. They also help B cells to grow and develop antibodies more quickly.
- **Cytotoxic T cells- (CD8 Cells)** Patrol the body looking for and can destroy pathogenic cells directly including cancerous cells.

16

FOUR STAGES IN IMMUNE RESPONSE

- Recognition
- Proliferation
- Response
- Effector

17



18

19

NON-T AND NON-B LYMPHOCYTES INVOLVED IN IMMUNE RESPONSE

- Null cells
  - Destroy antigen coated with antibody
- Natural killer cells
  - Defend against microorganisms and some malignant cells

20

COMPLEMENT SYSTEM

- https://youtu.be/Zb9S_K8h1F8

21

COMPLEMENT SYSTEM

- Circulating plasma proteins made in the liver and activated when antibody connects to antigen playing an important defense against microbes
- Activated by three pathways: classic, lectin, and alternative

22

VARIABLES THAT EFFECT IMMUNE SYSTEM FUNCTION

- Age and gender
- Nutrition
- History of infection or immunization
- Allergies
- Presence of conditions or disorders: autoimmune disorders, cancer or neoplasm, chronic illness, surgery or trauma
- Medications and transfusions
- Lifestyle
- Psychoneuroimmunologic factors

23

ADVANCES IN IMMUNOLOGY

- Genetic engineering: DNA technology
- Stem cells:
  - Research shows that stem cells can restore an immune system that has been destroyed
  - Clinical trials using stem cells are under way in patients with a variety of disorders having an autoimmune component, including systemic lupus erythematosus, rheumatoid arthritis, scleroderma, and multiple sclerosis
  - Along with these remarkable opportunities, many ethical challenges arise

24

ASSESSMENT OF THE IMMUNE SYSTEM

- Health history, including nutrition, infections, immunizations, allergies, autoimmune disorders, cancer, and chronic illness
- Physical exam, including lymph node assessment in addition to other body systems

25

TESTS TO EVALUATE IMMUNE FUNCTION

- WBC count and differential
- Bone marrow biopsy
- Humoral and cellular immunity tests
- Phagocytic cell function test
- Complement component tests
- Hypersensitivity tests
- Specific antigen–antibody tests
- HIV infection tests

26

NURSE'S ROLE IN EVALUATION OF THE IMMUNE SYSTEM

- Offer support
- Reduce anxiety
- Provide patient education and counseling

27

IMMUNOSUPPRESSANTS

- Drugs that decrease or prevent an immune response, thus suppressing the immune system
- Used to prevent or treat rejection of transplanted organs
- Immunosuppressive therapy
- Uses: rheumatoid arthritis, systemic lupus erythematosus, Crohn's disease, multiple sclerosis (MS), myasthenia gravis, psoriasis, and others

28

IMMUNOSUPPRESSANTS (CONT.)

- All suppress certain T-lymphocyte cell lines, thus preventing their involvement in the immune response.
- Results in a pharmacologically immunocompromised state (Similar to cancer or AIDS)
- Mechanisms of action vary according to drug.

29

TRANSPLANTS

- Types: kidney, heart, liver, lung, pancreas, small bowel, bone marrow, and cornea transplantation
- Rejection: primary concern; occurs from an immune response targeted against the transplanted organ
- **Immunosuppressant drugs are used to inhibit the immune system and prevent organ rejection**.
- **Transplant patients are on immunosuppressant therapy for the duration of their lifetime**.
- Cost of therapy can average more than $2500 per month.

30

IMMUNOSUPPRESSANTS (CONT.)

- **cyclosporine (Sandimmune)**

31

MECHANISM OF ACTION

- Acts on helper T lymphocytes to suppress production of IL-2, interferon gamma, and other cytokines.
- Thus, proliferation of B cells and cytologic T cells is suppressed.
- In contrast to other immunosuppressants, cyclosporine does not cause bone marrow suppression,

32

IMMUNOSUPPRESSANTS (CONT.)

- Cyclosporine (Sandimmune)
  - Prevention of organ rejection of an allogenic transplant.
  - May be used for other autoimmune disorders
  - A glucocorticoid is usually given concurrently,
  - **Several black box warnings:** renal impairment (structural kidney damage), increased risk of serious and fatal infections, hepatotoxicity, and may increase risk of developing a tumor (lymphomas) or skin cancer
  - May also cause hirtuism

33

PHARMACOKINETICS

- Can be given orally and IV
- Drug levels need monitored periodically
- 90-98% protein bound
- Extensively metabolized and excreted in **bile**

34

PREGNANCY/CYCLOSPORIN

- Embryotoxic
- Encourage use of mechanical contraceptives
- Avoid oral contraceptives
- Warn patient against breast feeding

35

AUDIENCE RESPONSE SYSTEM QUESTION

A patient who had a kidney transplant is receiving cyclosporine orally in maintenance doses. What action would decrease the potency of this drug?

A. Taking it with orange juice
B. Taking it with milk
C. Using a Styrofoam container to administer the drug
D. Mixing it with chocolate milk

36

NURSE WILL ASSESS:

- Monitor for therapeutic effects
- Graft tenderness or fever may indicate rejection,
- In renal transplant patients elevated BUN and Creatine may indicate rejection.,

37

IMMUNOSUPPRESSANTS (CONT.)

- Adverse effects vary according to drugs and may be devastating.
- ***All immunosuppressed patients have a heightened susceptibility to opportunistic infections.***

38

NURSING IMPLICATIONS

- Perform a thorough assessment before administering immunosuppressants:
  - Renal, liver, and cardiovascular function studies
  - Monitor BP
  - Central nervous system baseline function
  - Respiratory assessment
  - Baseline vital signs
  - Baseline laboratory studies, including hemoglobin, hematocrit, white blood cell (WBC) count, and platelet count

39

NURSING IMPLICATIONS (CONT.)

- Assess for contraindications, drug allergies, and drug interactions.
- Note nephrotoxic drugs may enhance renal damage
- Cyclosporin can increase levels of Repaglinide (Prandin) and cause hypoglycemia.
- Monitor WBC counts throughout therapy; if the count drops below normal range, contact the prescriber.

40

AUDIENCE RESPONSE SYSTEM QUESTION

Which potential problem is of most concern for a patient receiving immunosuppressant drugs?

A. Orthostatic hypotension
B. Increased susceptibility to infections
C. Neurotoxicity
D. Peripheral edema

41

NURSING IMPLICATIONS (CONT.)

- Oral immunosuppressant drugs should be taken with food to minimize gastrointestinal upset.
- Oral forms are used when possible to decrease the risk of infection that may occur with parenteral injections.
- Note that there are several possible drug interactions.
- **Grapefruit juice also inhibits metabolism of this drug and can increase cyclosporin levels**

42

NURSING IMPLICATIONS (CONT.)

- Oral antifungal drugs are usually given with these drugs to treat oral candidiasis that may occur.
- Assess the oral cavity often for white patches on the tongue, mucous membranes, and oral pharynx.

43

43

NURSING IMPLICATIONS (CONT.)

- **Mix oral cyclosporine solution in a glass container.**
- **Do not use Styrofoam containers because the drug adheres to the inside wall of the container**.

44

44

AUDIENCE RESPONSE QUESTION

A patient is being discharged on cyclosporine therapy. Which statement by the patient indicates that more teaching is needed? "I will take the cyclosporine tablet with:

A. water."
B. milk."
C. grapefruit juice."
D. apple juice."

45

45

NURSING IMPLICATIONS (CONT.)

- Follow guidelines for parenteral administration carefully.
- Inform patients that lifelong therapy with immunosuppressants is indicated with organ transplantation.

46

NURSING IMPLICATIONS (CONT.)

- **Patients taking immunosuppressant drugs should be encouraged to take measures to reduce the risk of infection:**
  - **Avoid crowds.**
  - **Avoid people with colds or other infections.**
- **Inform patients to immediately report fever, sore throat, chills, joint pain, fatigue, or other signs of a severe infection.**

47

NURSING IMPLICATIONS (CONT.)

- Monitor for therapeutic responses.
- Monitor for adverse effects and signs of drug toxicity.

48

TACROLIMUS (PROGRAF)

- Alternative to cyclosporine for preventing allograft rejection
- Somewhat more effective than cyclosporine, but more toxic.

49

https://youtu.be/IXMc15dA-vw

50

VACCINES

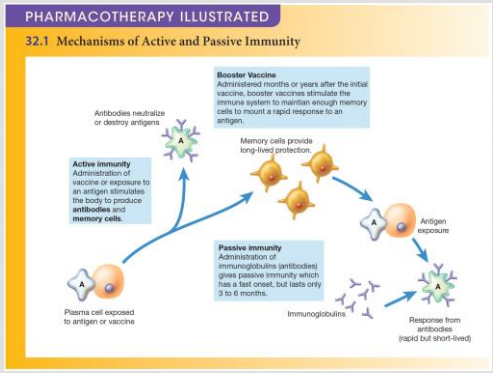
- Process of introducing foreign proteins or inactive cells (vaccines) into the body to trigger immune activation before the patient is exposed to the real pathogen.
- Memory B cells are formed
- When later exposed to actual organism, these cells will respond by producing antibodies that will help neutralize or destroy the pathogen.
- Boosters
- Titers

51

CONTRAINDICATIONS

- Vaccines are contraindicated for patients who have a weakened immune system, or experiencing diarrhea, vomiting, or fever/ active infection.
- Use in pregnancy is usually contraindicated

52



53