

Chapter 15 Immune Disorder

Immune - 'free from burden'

Immunology - science which deals with body's ability to distinguish self from nonself.

Immune system - specialized cells & tissues. Also called host defense system.

Immune System has 3 main functions:

- 1.) protect body's internal environment against invading organisms.
- 2.) Maintain homeostasis by removing damaged cells from circulation.
- 3.) Serve as surveillance network for recognizing & guarding against development & growth of abnormal cells.

Immunocompetence - when immune system responds appropriately to a foreign stimulus, body's integrity maintained.

Immune response too weak or too vigorous, homeostasis is disrupted causing immunoincompetence.

Inappropriate responses of immune system have been classified into 4 categories:

- 1.) hyperactive - allergies
- 2.) inability to protect body, as in immunodeficiency - Aids
- 3.) failure to recognize body as self - autoimmune disorders - SLE, RA
- 4.) attacks on beneficial tissue - organ transplant rejection

Immunity - being insusceptible to or unaffected by a particular disease or condition.

2 major subclassifications of immunity:

- 1.) innate (natural) - nonspecific. Provides physical & chemical barriers to invading pathogens against the external environment. Innate system is composed of skin & mucous membranes, cilia, stomach acid, tears, saliva, sebaceous glands, secretions, & flora of intestines & vagina.
- 2.) Adaptive (acquired) Immunity - to assist in the battle. Body's second line of defense against disease. Provides specific reaction to each invading antigen & has the ability to remember the antigen that caused the attack. Protects the internal environment. Composed of highly specialized cells & tissues, thymus, spleen, bone marrow, blood, & lymph. Includes both humoral & cell mediated immunity. Characteristics are being specific & memory. Specific immunity results from production of antibodies in the cells. Antibodies develop naturally after infection or artificially after vaccinations.

Cells of immune system are macrophages & lymphocytes.

Lymphocytes include T and B cells, NK (natural killer) cells.

70-80% of lymphocytes are T-cell lymphocytes.

T cells, when activated, release substance called lymphokine.

Lymphokine - chemical factor produced & released by T cells that attracts macrophages to site of infection/inflammation & prepares them for attack.

T cells cooperate with B cells to produce antibodies but do not produce antibodies themselves.

T cells are responsible for cell-mediated immunity & provide body with protection against viruses, fungi, parasites, & allograft, & malignant cells.

B cells - 20-30% of lymphocytes.

B cells cause the production of antibodies & proliferate (increase in #) in response to a particular antigen (Foreign body).

An antigen is usually a protein that causes the formation of an antibody & reacts specifically with that antibody.

B cells migrate to the peripheral circulation & tissues & are filtered from lymph & stored in lymphoid tissue of the body.

B cell proliferation depends on antigen stimulation.

B cells are responsible for humoral immunity, produce antibodies, provide protection against bacteria, viruses, & soluble antigens.

HUMORAL IMMUNITY

Mediated by B cells

B cells produce antibodies in response to antigen.

On first exposure to antigen, primary humoral response is initiated-response is slow.

On second exposure memory B cells cause response-quick-(regardless whether first exposure was to antigen/immunization.)

Immunization-process by which resistance to an infection disease is induced or increased.

T lymphocytes can be categorized into T-helper (CD4) and T-suppressor (CD8) cells.

B cells initiate production of antibodies.

Suppressor T cells maintain humoral response.

Antibodies produced by one's own body provide active immunity. (vaccination)

Antibodies formed by another in response to a specific antigen & administered to an individual provide only temporary or passive immunity (Hepatitis B)

IMMUNOCOMPETENCE-ability of an immune system to mobilize & deploy its antibodies & other responses to stimulation by an antigen.

The # & functions of helper & suppressor T cells help determine the strength & persistence of an immune response.

Normal ratio of helper T cells to suppressor T cells 2:1

Exposure to antigen & response with antibody may activate either:

- 1.) humoral complement
- 2.) antigen/antibody-mast cells release histamine.

Antigen referred to as allergen-substance that can produce a hypersensitive reaction but not harmful.

Humoral immunity-result of development & continuing presence of circulating antibodies in the plasma.

Humoral means body fluid.

Antibodies are proteins found in plasma-humoral immunity.

CELLULAR IMMUNITY

Also called cell-mediated immunity, results when T cells are activated by an antigen.

Cellular immunity-primary defense against intracellular organisms.

Cellular immunity is involved in resistance to infectious diseases caused by viruses & some bacteria.

COMPLEMENT SYSTEM

System of approximately 25 serum enzymatic proteins that interact with one another & with other components of the innate (natural) & adaptive (acquired) immune system.

When antigen & antibody interact, complement system is activated.

Complement system can destroy the cell membrane of many bacterial species, & this attracts phagocytes to the area.

Immune system develops @ different rates & @ different times in fetal & early life. Bone marrow provides the continuous service of stem cells & all other cells involved in immune response.

EFFECTS OF AGING ON IMMUNE SYSTEM

With aging there is a decline in the immune system.

Bone marrow is relatively unaffected by increasing age.

Thymus-decreases in size & activity with aging.

T & B cells show deficiencies in activation, transit time, & differentiation.

Thymic output of T cells diminish.

There is an accumulation of memory cells rather than new cells.

Delayed hypersensitivity response (skin testing), is decreased or absent in older adults.

IMMUNE RESPONSE

2 ways of assisting the body to develop immunity:

- 1.) immunization
- 2.) immunotherapy

Immunization-controlled exposure to a disease-producing pathogen develops antibody while preventing the disease.

Attenuated-weakened

In immunization the immune system has a greater response to a second encounter with an antigen.

The vaccine, or toxoid, stimulates humoral immunity, which provides protection from disease for months to years.

Immunotherapy- special treatment of allergic responses that administers increasingly large doses of the offending allergens to gradually develop immunity.

Consists of injecting a person with a diluted antigen(allergen) to which person has type I hypersensitivity. The strength of the dilution is increased over a long period, & weekly injections are given over a 1-3 year period.

Theory behind immunotherapy is to assist the patient to build a tolerance to the allergen without developing fever or increased signs & sx.

Desensitization-another term for immunotherapy.

Immunotherapy may be co-seasonal, preseasonal, or perennial.

Perennial therapy most accepted because it allows for higher cumulative dose, which produces better effect. Usually begins with 0.05ml of a 1:10,000 dilution & increases to 0.5ml in a 6 week period. PAGE 758.

Perennial therapy is administered sub-Q & pt. must ALWAYS be observed for @ least 20 minutes after administration because of hypersensitivity reaction or anaphylaxis.

Treatment protocol for anaphylaxis with immunotherapy is generally accepted to be 0.2 to 0.5 ml of 1:1000 epinephrine sub-q every 20 minutes for 3 doses.

Dr. should be consulted before administering a dose of diluted allergen if illness or interruption of time schedule has occurred while pt. is on maintenance immunotherapy.

Severity of altered immune response disorders ranges from mild to chronic to life threatening & is categorized:

- I. Hypersensitivity disorder-involves allergic response & tissue rejection
- II. Immunodeficiency disease-involves altered & failed immune response
- III. Autoimmune disease-involves extensive tissue damage resulting from an immune system that seems to reverse its function to one of self destruction.

DISORDERS of the IMMUNE SYSTEM

Hypersensitivity-abnormal condition characterized by an excessive reaction to a particular stimulus.

Hypersensitivity reaction is an inappropriate & excessive response of the immune system to a sensitizing antigen.

Hypersensitivity disorders arise when harmless substances-pollens, danders, foods, & chemicals are recognized as foreign.

Host becomes sensitive after first exposure, & on subsequent exposure the pt. has hypersensitivity reaction.

Believed to be genetic defect with release of histamine & other mediators from mast cells & basophils.

Signs & Sx. occur as a result of histamine release & cause vasodilation, edema, bronchoconstriction, mucus secretion, & pruritus.

Reaction may be local or systemic.

Treatment of hypersensitivity disorders:

- 1.) Manage Sx. with medications
- 2.) Environmental control
- 3.) Immunotherapy.

The most effective treatment is environmental control, avoidance of the allergen.

Medications are used to treat & alleviate signs & sx.

Antihistamines must be initiated soon after exposure or taken on a regular basis.

ANAPHYLAXIS

Most severe allergic reaction.

Antigens causing anaphylaxis:

- 1.) venoms
- 2.) drugs (PCN & ASA)
- 3.) contrast media dyes
- 4.) insect stings
- 5.) some foods

Reaction occurs very rapidly after exposure, seconds to few minutes.

Reactions are classified as mild, moderate, & severe

The more rapid the onset, the more severe the outcome is.

Immediate aggressive treatment-@ first sign, 0.2 to 0.5 ml of epinephrine 1:1000 is given sub-q for mild symptoms. It may be repeated @ 20-minute intervals.

Severe reactions-epinephrine 1:10,000, 0.5 ml IV @ 5 to 10 minute intervals.

Benadryl 50 to 100 mg may be given IM or IV.

If moderate to severe signs & sx. occur, IV therapy may be initiated to prevent vascular collapse.

O₂, place pt. in recumbent position & elevate legs, keep warm.

Allergies to latex products have increased.

2 types latex allergies: type IV-contact dermatitis
type I allergic reaction

TRANSFUSION REACTIONS

Hypersensitivity disorder.

Blood & blood components should be refrigerated until ½ hr. before administration.

Blood must be administered within 4 hours of refrigeration, & blood components within 6 hours.

Donor & recipient # are specific & MUST be thoroughly checked.

Nurse monitors for adverse effects.

Transfusion reactions are labeled mild, moderate, severe.

Most severe reactions occur within the first 15 minutes, moderate reactions within 30 to 90 minutes, & mild reactions may be delayed to late in the transfusion or hours to several days after transfusion.

Mild transfusion Reactions S and Sx:

Dermatitis urticaria

Diarrhea cough

Fever orthopnea

Chills

Treatment:

- 1.) STOP transfusion
- 2.) Administer saline, steroids, diuretics

Severe Reaction-transfusion stopped & blood or blood product returned to lab for immediate testing. Urine specimen is sent to lab if reaction occurs.

Autologous-tissue occurring naturally & derived from same individual. Best method for prevention of transfusion reaction. Blood can be frozen & stored for as long as 3 years.

Delayed hypersensitivity reactions can occur 24-72 hours after exposure.

Transplant Rejection:

Autograft-transplant of tissue from one site to another on an individual

Isograft-transplantation between genetically identical individuals, twins

Allograft-transplantation between members of same species.

Tissue rejection does not occur immediately after transplantation. It takes several days for vascularization to occur. 7 to 10 days after blood supply established, sloughing occurs @ site.

Graft rejection slowed with medications: corticosteroids, cyclosporine, Imuran and called immunosuppressive therapy.

Infection is threat to the immunosuppressed patient.

Immunodeficiency-abnormal condition of the immune system in which cellular or humoral immunity is inadequate & resistance to infection is decreased.

First sign or evidence of immunodeficiency is increased susceptibility.

Drug induced immunosuppression is the most common type secondary immunodeficiency disorder.

Stress may alter immune response.

A hypofunctional state of the immune system exists in young children & older adults.

Malnutrition may cause alteration in immune system

Radiation, surgical removal of lymph nodes, thymus, or spleen can suppress immune response.

Autoimmune-immune attack on self.

Autoimmune diseases tend to cluster, so patient may have more than 1 autoimmune disease.

Plasmapheresis-removal of plasma that contains components causing disease.

When it is removed it is replaced by substitution fluids such as saline/albumin. This has been done to treat autoimmune diseases such as SLE, RA (page 765).

The rationale for this procedure is to remove pathologic substances present in plasma.