Nursing Care of the Patient with Disturbances of Immunological Systems

Allergies

Immune System

Network of cells, tissues, organs that work together to defend body against attacks by foreign invaders

Key to healthy immune system:

Ability to distinguish between own cells & foreign cells

Types of Immunity:

Innate: present at birth

Acquired: developed either actively or passively

Active acquired: long lasting; body develops antibodies when exposed or artificial via vaccine

Passive acquired: short lived; person received antibodies rather than making them; mom → baby via placenta

3 Functions of the Immune System

Defense- protects the body against foreign cells and pathogens

Homeostasis- removes damaged cells

Surveillance- targets mutations as abnormal/ foreign and marks them for destruction

Antigen

Substance that triggers immune response

An invading body-foreign to person

All of body's cells have antigens on surface of cells that identify cell as self or non-self

Allergy

Interaction between antigen & antibody

Altered adverse reaction to foreign substance that doesn't normally cause reaction.

-life threatening or just annoying.

Atopy *(Atopic Reaction)* -genetic trait predisposing for localized anaphylaxis

Antigens Can Enter the Body by Four Methods

Ingestion - proteins - milk, wheat, egg whites.

Inhalation - pollen, dust, mold spores.

Injection – PCN.

Absorption - across skin or mucous membrane.

Antibody

Substance synthesized by B lymphocytes in response to presence of specific antigen

Class of proteins = immunoglobulins

Lymphocytes

Produced in bone marrow

Two types:

B lymphocytes (Humoral Immunity)– in the bone marrow
Differentiate into plasma cells when activated
Produce antibodies

T lymphocytes (Cell-Mediated Immunity)– cells that move from bone marrow to thymus
Responsible for immunity to viruses, tumor cells & fungus.
Can attack infected or cancerous cells.

Humoral Immunity
(Body fluid)
Antibody-mediated immunity
B lymphocytes produce antibodies

Immune Response:
Pathogen (or bacteria) enters body > may encounter B lymphocyte specific for antigens located on bacterial cell wall > B cell becomes activated & differentiates into mature plasma cells ⇒ these secrete immunoglobulins.

Primary immune response noted 4-8 days after initial exposure

Five types of immunoglobulins (antibodies)
1) IgG
2) IgM
3) IgA
4) IgD
5) IgE

IgG
Only IgG can cross the placenta
Provides newborn with passive immunity **for at least 3 months**
Immunity from Mom to fetus

Responsible for **secondary** immune response
Produced as the immune response progresses
Reoccurrence!

IgM
First type of antibody formed
Primary immune response- can kill bacteria.
Large in size - confined to intravascular space

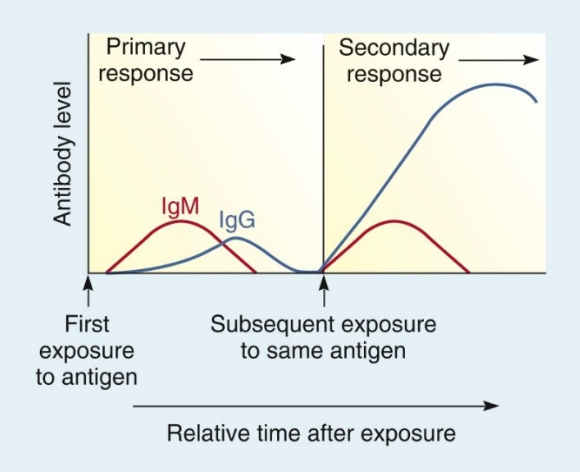
IgA
Protects against infection in intestines & respiratory tract.
Lines mucous membranes & protects body surfaces
Guards entrances. (i.e. Tears, saliva, etc.)

IgD
Present on lymphocyte surface

Assists in differentiation of B lymphocytes

IgE

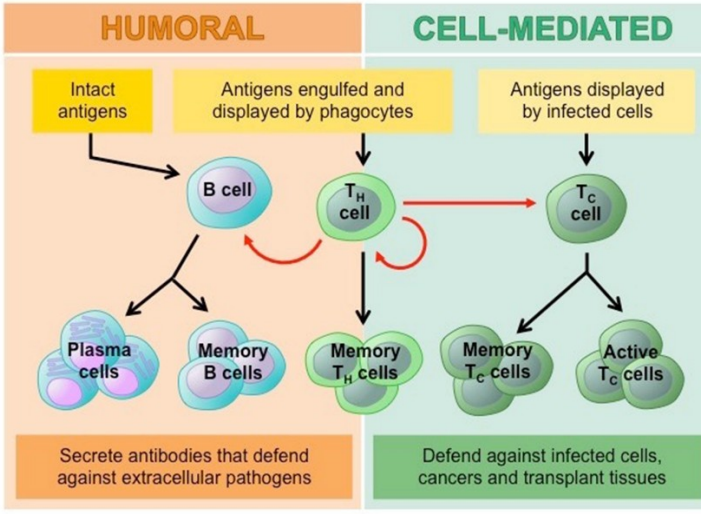
Causes symptoms of allergic reactions
Hayfever, asthma, eczema
Fixes to mast cells & basophils
Assists to defend vs. parasites



Cell-Mediated Immunity

Immune responses initiated through specific antigen recognition by **T cells**
Immunity against pathogens that survive inside cells

Virus, some bacteria (mycobacteria = TB), fungal infections, rejection of transplanted tissues, contact hypersensitivity, tumor immunity



Sequence of Events in Immune Response

-Antigen introduced into body.
-Initial latent period (induction period) during which no antibodies can be detected in serum.
-Rapid rise in antibody production - reaches peak level & then declines to low maintenance level
Both IgG & IgM type antibodies present in this primary response.
-If antigen introduced again, antibody responds again much more rapidly & reaches higher titer.
Response-body remembers how to produce antibody-produced faster & more efficiently than 1st time.

-IgG-main antibody produced with repeated antigen stimulation

Hypersensitivity Reactions

An abnormal or allergic reaction to an antigen-antibody formation
Classified by source of antigen, time sequence, mechanism
4 Types:
Type I, II, III – immediate, humoral
Type IV – delayed, cell-mediated

When immune response over reactive against foreign antigens
A type is then the body fails to recognize self-proteins and reacts against its own protein = **Autoimmune Diseases**

Pathology of Hypersensitivity Reactions

Appears to be release of certain chemical mediating substances to attack target organs
→ Early mediator = **histamine**
Histamine causes:
Vasodilation, Smooth muscle contraction
Capillary dilation – Increased vascular permeability
↑ Fluid into tissues

Pathology of Hypersensitivity Reactions

Other substances released:
-Serotonin – increased vascular permeability; stimulates smooth muscle contraction
-Prostaglandins - vasodilation, constrict smooth muscle.[walls of blood vessels]
-Kinins (usually bradykinins) stimulate nerve endings to cause throbbing & pain.
Combined : These responses cause symptoms of allergies

Hypersensitivity Reactions

Don't occur 1st time someone exposed to antigen
Occur after number of exposures
Become sensitized to antigen

Four types of Hypersensitivity Reactions

Type I: IgE-Mediated Reactions

Anaphylactic Reactions (Immediate)
Occur only in susceptible persons highly sensitized to specific allergens
IgE antibodies produced in response to antigen.
Examples - allergic rhinitis (hayfever), asthma, atopic dermatitis, food/drug allergies, urticaria (hives).
S&S - depends on whether mediators remain local or become systemic or if they affect certain organs

Localized reaction
"Wheal & flare" –cutaneous (skin) reaction
Pale wheal containing edematous fluid surrounded by red flare from hyperemia
Occurs in minutes to hours
Usually not dangerous

Systemic Reaction

Anaphylaxis/anaphylactic shock occur when mediators released systemically
Occurs in minutes -life threatening due to bronchial constriction ➔ airway obstruction & vascular collapse
Initial S&S - edema, itching at site of allergen exposure
Shock follows-rapid, weak pulse, low blood pressure etc.
Death can occur

Atopic reaction

Inherited tendency to become sensitive to environmental allergens (allergic rhinitis, asthmas, urticaria, atopic dermatitis)

Angioedema-atopic reaction

Localized cutaneous but involving deeper layers-eyelids, lips, tongue, larynx, hands, feet
Begins in face progresses to airway & other parts of body-diffuse swelling

Type II:
Cytotoxic and Cytolytic Reactions

Body makes auto-antibodies directed against self cells
"Self Cells are destroyed by phagocytosis or lysis
Cellular tissue destroyed
Target cells frequently destroyed in Type II reactions erythrocytes, platelets, leukocytes

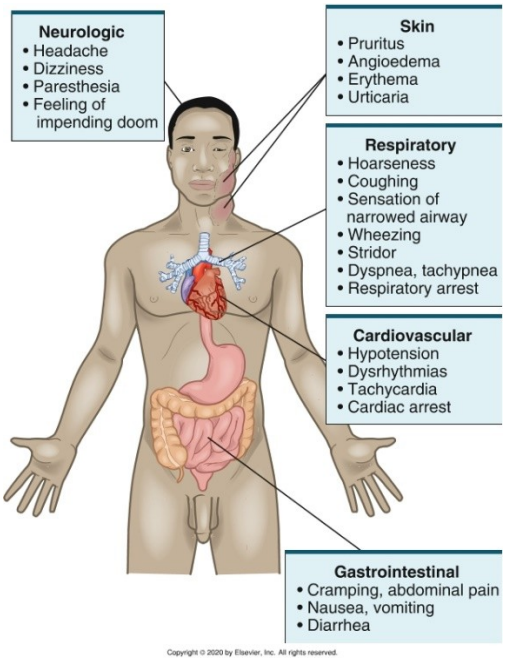
Examples - ABO incompatibility transfusion reactions, Rh incompatibility transfusion reactions, leukopenias, thrombocytopenias, hemolytic anemia

Type III
Immune Complex Reactions

Tissue damage due to antigen-antibody complexes
Antigens combine with antibodies (IgG & IgM) form complexes that deposit in tissues
→ Causes acute inflammation, damage to tissue &/or blood vessels
Common sites for deposit:
→ Kidneys, skin, joints, BV, lungs
Severe type III reactions include:
→ autoimmune disorders (lupus, rheumatoid arthritis, acute glomerulonephritis)

Type IV
Delayed Hypersensitivity Reactions (Cell Mediated Immune Response)

Tissue damage occurs without presence of an antibody
T lymphocytes & macrophages destroy the antigen
24-48 hours before reaction occurs
Contact dermatitis, transplant rejections, reactions to some bacterial, fungal, viral infections, or some drug reactions



Assessment

Health History

Family history of allergies-type, symptoms

Past and present allergies

ID allergens, time of year of reaction, OTC & Rx meds used to treat allergies

ID symptoms & course of allergic reactions

ID social & environmental factors

pets, trees, plants, air pollutants, carpet, cooling/heating systems

Food diary - daily or weekly

Gerontologic: there is a decline in the function of immune responses as we age: decreased cell-mediated immunity, decreased delayed hypersensitivity rxn, decreased primary and secondary antibody responses, more autoantibodies

Check for medical reactions

Assess patient's lifestyle, stress level, connection with allergy

Assess 4 categories ➔ inhalants, contacts, ingestions, injectable

Physical exam

Complete head-to-toe exam

Focus on allergic manifestations

➔Skin-rashes, wheal, hives (urticaria), etc.

➔EENT -red eyes, itchy eyes/nose, sniffling, decreased hearing

➔Respiratory - wheezing, sputum

Diagnostic Testing & Studies

CBC+WBC differential

lymphocyte & eosinophil counts

RAST-radioallergosorbent test

Specific test for IgE antibodies to specific allergens

Expensive, effective for individuals with severe anaphylactic reactions

Less sensitive, quicker results

Food & drug allergies

Sputum, nasal, bronchial secretions → tested for eosinophils

Skin Testing

Purpose - to detect presence of atopic reactions to IgE in skin or to isolate antigen (allergen) to which person sensitive

Procedure:
Methods: scratch/prick or injection, or patch test
Allergen introduced into skin (arm, back)
If sensitive = wheal & flare
Release of histamine➔ local dilation
Appears quickly ➔ 15-20 minutes

Methods of Skin Testing

Types of skin tests:

1 **Cutaneous scratch or prick**
Scratch or prick
Area washed with alcohol
Drop of allergen applied to skin & area scratched (lancet)/pricked (needle)-sterile
Applied in rows with corresponding control sites opposite test rows

2 Intracutaneous (injection)
Inject small amount of solution of allergen below epidermis-in rows
Forearm used
Allergic reaction more severe with this method
Only used for persons who did not react to cutaneous methods

3 Patch Test
Allergen applied to a patch
Must be worn for 48-72 hrs
Tests for dermatitis

Results

-Hypersensitivity to allergen = positive reaction (wheal/flare response) occurs minutes with insertion in skin & may last up to 8-12 hours.
-Patch = inflamed skin under patch site
-False positive or negative results
-Size of reaction- depends-severity of allergy symptoms
-Positive results = sensitive

Precautions

Highly sensitive → at risk for anaphylactic reaction
Never leave alone during
If severe reaction to skin/scratch test – extract, removed & anti-inflammatory topical cream applied.
If severe reaction to intracutaneous test – tourniquet applied to arm & subcutaneous injection of epinephrine may be needed.

Collaborative Care

Lifestyle adjustment- avoid allergen
Even with treatment may have symptoms
Change diet
Avoid Stress/Fatigue
Change climate/environment
Allergy bracelet

Pharmacological Treatment

Antihistamines

Best meds for tx of allergic rhinitis & urticaria
Less effective for severe allergic reactions
Given orally, IV, topical, inhaled or nasal spray
Action → competes with histamine for H, receptor sites thus blocking effect of histamine
Best if taken when symptoms appear
Side effects -drowsiness, sedation, disturbed coordination (use caution driving, operating machinery).
Benadryl, Zyrtec, Chlor-trimeton
New generation of meds -loratadine-Claritin, cetirizine-Zyrtec, fexofenadine- Allegra, desloratadine-Clarinex = decrease side effects.

Sympathomimetic/Decongestant Meds

Major sympathomimetic med epi (adrenalin)
Drug of choice for anaphylactic reaction
Hormone produced by adrenal medulla that stimulates A & B-adrenergic receptors.
-Vasoconstriction of peripheral blood vessels = ↓ edema
-Stimulation of B receptors relaxes bronchial smooth muscle spasms.
Action of epi lasts few minutes.
Treatment of anaphylaxis - drug must be given parenterally (IM, IV)
Minor sympathomimetic drugs (po, nasally) (last for several hours) – phenylephrine = Neo-synephrine, pseudoephedrine = Sudafed ⇒ treatment of allergic rhinitis.
Oxymetazoline = Afrin- causes rebound congestion if used > 72 hrs.

Corticosteroids

-Nasal corticosteroids (vancenase, rhinocort, flonase)
Relieve symptoms of allergic rhinitis –decrease inflammation
-Oral corticosteroids - brief course for severe reactions

Antipruritics

Topically applied
Most effective when skin intact (not broken)
Provide relief from itching
OTC- Calamine or Benadryl Lotion

Mast-Cell Stabilizing Drugs

Inhibit release of histamines, leukotrienes (chemical mediators of inflam) & other agents from mast cells
Inhalant nebulizer, nasal spray, po
Cromolyn spray (intal, nasalcrom) – decrease side effects.
Use before exposure to allergen-(cats, pollen season) (type I reaction).
Montelukast- Singulair – leukotriene receptor inhibitor

Immunotherapy

For anaphylactic reactions⇒ Desensitization
Given injections weekly for up to 5 years
*allergy shots
Injections may cause reaction. Use arm- monitor 20 minutes.
May need maintenance for severe reactions to insects
Sublingual: daily
Attempt to stimulate IgG levels to mediate IgE to mast cells = reduces reactions & tissue damage.

Anaphylaxis

Occur suddenly in hypersensitive with exposure to allergen
Can occur after injection of drugs (abx), blood products, insect stings.
Mild symptoms = pruritus & urticaria
Severe symptoms = bronchial constriction, airway obstruction, vascular collapse (shock).

5 principles in therapeutic management of anaphylaxis:
Speed in recognition of anaphylactic reaction.
Speed in maintenance of patent airway
Speed in prevention of spread of allergen by using tourniquet (i.e. snake bites).
Speed in med administration.
Speed in treatment for shock.

Therapeutic Management:

Mild symptoms (pruritus and urticaria):
Epinephrine 1:1000 (0.01ml/kg)
(0.3-0.5 ml) IM, q 5-15 min as needed
Severe reaction:
Epinephrine 1:10,000 (0.1ml/kg) (3-5 ml) IV q 2-5 min intervals

-High flow oxygen via non-rebreather mask
-Recumbent position with legs elevated
-Keep warm
-Dysphenhydramine (benadryl) IM or IV for urticaria & angioedema
-Maintain BP with fluids, vasopressors (dopamine)

Serum Sickness

Type III reaction
Involves deposits of antigen-antibody complexes in blood vessel walls of skin, joints, in renal glomeruli
Systemic disorder
Develops slowly ➔ 10-14 days
Self-limiting
Triggers for serum sickness
Most common = PCN, or other abx (amoxicillin, Keflex, Bactrim), snake bites,
Animal serum-based drugs (horse serum used for diphtheria and scarlet fever)

Unlike Type I reaction, don't need to be previously sensitized to react
Antigen remains in high levels in body for several days & reacts with antibodies formed in about two weeks from initial exposure.

S/Sx:
Urticaria, angioedema, fever, muscle soreness, malaise, lymphadenopathy, joint pain, polyarthritis, nephritis

Symptomatic treatment: steroids, antihistamines, analgesics

Latex Allergies

Increased incidence of latex hypersensitivity
esp. frequent caths, spina bifida
incidence in healthcare workers is ↓ due to changes in the workplace.
Increased use latex gloves with universal precautions in 1987.
More frequent & prolonged exposure to latex > likelihood of developing latex allergy.

Latex containing products:
Tourniquets, BP cuffs, IV tubing, Syringes, Electrode pads, O2 masks/tubing, Colostomy pouches, Urinary catheters, Adhesive tape

Latex proteins aerosolized through powder in gloves result in serious reactions when inhaled by sensitive people.

Two types of latex allergies:

Type IV allergic contact dermatitis:
Caused by chemicals used in manufacturing process of latex gloves.
Delayed reaction - occurs in 6-48 hrs.
Symptoms = dryness, pruritus, fissuring, cracking of skin, followed by redness, swelling, crusting at 24-48 hrs.

Type I allergic reaction
Response to natural rubber latex proteins & occurs in minutes of contact with proteins.
Symptoms = skin redness, urticaria, rhinitis, conjunctivitis, asthma, full blown anaphylactic shock.

Nursing Management:

Thorough health history of allergies

Risk factors for latex sensitivity:
Long-term multiple exposures to latex products (health care staff, patients with many OR visits).
Hx of Hayfever or Asthma
Allergies to foods (**avocados**, guava, **kiwi, bananas**, **water chestnuts**, hazelnuts, tomatoes, potatoes, peaches, grapes, apricots).

-Latex sensitive people wear medic alert bracelet & carry epi kit (pen).
-Follow hospital policy.
-Use latex free supplies for the patient.
-Latex allergy band on the patient