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Medical and surgery assignment.

1) The role of the immune system

The role of the immune system is to protect our body from any foreign matters that might cause any damage or homeostatis imbalance. The success of the immune system depends on its ability to discriminate between foreign(non self) and host(self) cells. When an organism is threatened by microorganisms, viruses, or cancer cells, the immune system acts to provide protection. Normally the immune system does not mount a response against self. This lack of an immune response is called tolerance.

When a foreign matter enters the human body, our defense system recognizes this as foreign through the immune system. How the human body recognize foreign against itself employs a complex "I.D." system. Each cell in the human body carries on it's surface a mixture of proteins and sugars that serve to identify the cell to the immune system. Foreign objects lack the identifiers that all of the body's cells have, but each one has unique features or antigens where the immune system attaches identifiers called antibodies. This is the basis for the specific defense mechanisms. Once you have built the antibodies for a specific antigen, the immune system will respond faster than if the had been no previous exposure to the antigen (i.e. you are immune to the pathogen, but only that specific pathogen, because your immune system responds faster.) The non-specific part of the immune system is mostly composed of phagocytes (eating-cells) which engulf and digest foreign substances like bacteria and viruses, which do not bear the body's specifc idenifers.

2) Types of immunity

a)INNATE IMMUNITY;

Innate, or nonspecific, immunity is the defense system with which you were born. It protects you against all antigens. Innate immunity involves barriers that keep harmful materials from entering your body. Plants and animals have what is called innate immunity. Innate immunity is the first line of defense against pathogens. It involves several cell types, proteins, and even an organ. The organ involved is your skin. Yes, skin is part of the first line of defense. It protects you and prevents pathogens from getting inside your body.

Pathogens enter through Air, food, or a break in the skin are some ways a pathogen enters. A pathogen entering through food or air has mucus to go through. The mucosal surfaces prevent pathogens from attaching to cells and causing disease. A set of proteins called the complement system is also involved. The complement system attacks the pathogen and marks it for destruction.

A pathogen getting through skin and mucus will have to deal with several types of cells including phagocytes, eating cells, and natural killer (NK) cells before it can cause disease. Pathogens have warning flags on their surface that say: 'I don't belong here'. Neutrophils, macrophages, and dendritic cells are all phagocytes. They recognize the warning flag, attack the pathogen, and eat it - a process known as phagocytosis. If a pathogen is too big for one cell alone, several cells attack at once.

Natural killer cells on the other hand, identify infected cells (host cells) and activate the host cell's death receptor pathway or give the cell a lethal injection (injecting enzymes that degrade proteins). Host cells even try to fight back by turning off machinery that would help the pathogen and sending out distress signal

Examples of innate immunity include:

I)Cough reflex

II) Enzymes in tears and skin oils

III)Mucus, which traps bacteria and small particles

Iv)Skin

V)Stomach acid

Innate immunity also comes in a protein chemical form, called innate humoral immunity. Examples include the body's complement system and substances called interferon and interleukin-1 (which causes fever). If an antigen gets past these barriers, it is attacked and destroyed by other parts of the immune system.

The major functions of the vertebrate innate immune system include:

1. Recruiting immune cells to sites of infection through the production of chemical factors, including specialized chemical mediators called cytokines.
2. Activation of the complement cascade to identify bacteria, activate cells, and promote clearance of antibody complexes or dead cells.
3. Identification and removal of foreign substances present in organs, tissues, blood and lymph, by specialized white blood cell.
4. Activation of the adaptive immune system through a process known as antigen presentation.

b) Adaptive immunity:

The adaptive immune system, also referred as the acquired immune system, is a subsystem of the immune system that is composed of specialized, systemic cells and processes that eliminates pathogens by preventing their growth. The acquired immune system is one of the two main immunity strategies found in vertebrates (the other being the innate immune system).

Acquired immunity creates immunological memory after an initial response to a specific pathogen, and leads to an enhanced response to subsequent encounters with that pathogen. This process of acquired immunity is the basis of vaccination. Like the innate system, the acquired system includes both humoral immunity components and cell-mediated immunity components

The acquired immune system is highly specific to a particular pathogen and it also destroys invading pathogens and any toxic molecules they produce. Sometimes the acquired system is unable to distinguish harmful from harmless foreign molecules; the effects of this may be hayfever, asthma or any other allergy.

The cells that carry out the acquired immune response are white blood cells known as lymphocytes. Two main broad classes—antibody responses and cell mediated immune response—are also carried by two different lymphocytes (B cells and T cells). In antibody responses, B cells are activated to secrete antibodies, which are proteins also known as immunoglobulins. Antibodies travel through the bloodstream and bind to the foreign antigen causing it to inactivate, which does not allow the antigen to bind to the host

The major functions of the acquired immune system include:

1. Recognition of specific "non-self" antigens in the presence of "self", during the process of antigen presentation.
2. Generation of responses that are tailored to maximally eliminate specific pathogens or pathogen-infected
3. Development of immunological memory, in which pathogens are "remembered" through memory B cells and memory T cells.

Types of acquired immune system includes:

Immunity can be acquired either actively or passively. Immunity is acquired actively when a person is exposed to foreign substances and the immune system responds. Passive immunity is when antibodies are transferred from one host to another. Both actively acquired and passively acquired immunity can be obtained by natural or artificial means.

1. Naturally Acquired Active Immunity – when a person is naturally exposed to antigens, becomes ill, then recovers.
2. Naturally Acquired Passive Immunity – involves a natural transfer of antibodies from a mother to her infant. The antibodies crosses the woman's placenta to the fetus. Antibodies can also be transferred through breast milk with the secretions of colostrum.
3. Artificially Acquired Active Immunity – is done by vaccination (introducing dead or weakened antigen to the host's cell).
4. Artificially Acquired Passive Immunity – This involves the introduction of antibodies rather than antigens to the human body. These antibodies are from an animal or person who is already immune to the disease.

3) Types of antibodies and their functions:

I) IgM

IgM usually circulates in the blood, accounting for about 10% of human immunoglobulins. IgM has a pentameric structure in which five basic Y-shaped molecules are linked together. B cells produce IgM first in response to microbial infection/antigen invasion.

Although IgM has a lower affinity for antigens than IgG, it has higher avidity for antigens because of its pentameric/hexameric structure. IgM, by binding to the cell surface receptor, also activates cell signaling pathways

Functions of IgM includes:

1. IgM binds to the polyimmunoglobulin receptor in a process that brings IgM to mucosal surfaces, such as the gut lumen and into breast milk. This binding depends on J chain.
2. IgM can bind complement component C1 and activate the classical pathway, leading to opsonization of antigens and cytolysis.
3. Control of B-cell activation: B-cells create IgM antibodies as a first line of defense. Their large size gives them excellent binding affinity , and can pick up trace amounts of infection to mark for recognition by phagocytes.
4. Their antibodies are mainly responsible for the clumping (agglutination) of red blood cells if the recipient of a blood transfusion receives blood that is not compatible with their blood type.

III). IgA

IgA is abundant in serum, nasal mucus, saliva, breast milk, and intestinal fluid, accounting for 10-15% of human immunoglobulins. IgA forms dimers (i.e., two IgA monomers joined together). IgA in breast milk protects the gastrointestinal tract of neonates from pathogens.

Functions of IgA includes:

1. An IgA test can help doctors diagnose problems with the immune system, intestines, and kidneys. It may be done in kids who have recurrent infections..
2. It's also used to evaluate autoimmune conditions, such as rheumatoid arthritis, lupus, and celiac disease.
3. Immunoglobulin A (IgA), as the principal antibody class in the secretions that bathe these mucosal surfaces, acts as an important first line of defence.
4. It is also an important serum immunoglobulin, mediates a variety of protective functions through interaction with specific receptors and immune mediators.

II). IgE

IgE is present in minute amounts, accounting for no more than 0.001% of human immunoglobulins. Its original role is to protect against parasites. In regions where parasitic infection is rare, IgE is primarily involved in allergy.

Functions of IgE includes:

1. IgE's main function is immunity to parasites such as helminths like Schistosoma mansoni, Trichinella spiralis, and Fasciola hepatica. IgE is utilized during immune defense against certain protozoan parasites such as Plasmodium falciparum.
2. IgE also has an essential role in type I hypersensitivity, which manifests in various allergic diseases, such as allergic asthma, most types of sinusitis, allergic rhinitis, food allergies, etc..
3. IgE also plays a pivotal role in responses to allergens, such as: anaphylactic reactions to drugs, bee stings, and antigen preparations used in desensitization immunotherapy.
4. It is most likely beneficial in removal of hookworms from the lung.

Iv). IgD

IgD accounts for less than 1% of human immunoglobulins. IgD may be involved in the induction of antibody production in B cells, but its exact function remains unknown.

Functions of IgD includes:

1. It helps to signal the B cells to be activated. By being activated, B cells are ready to take part in the defense of the body as part of the immune system.
2. It bind to basophils and mast cells and activate these cells to produce antimicrobial factors to participate in respiratory immune defense in humans.It also stimulates basophils to release B cell homeostatic factors.

v). IgG

IgG is the most abundant antibody isotype in the blood (plasma), accounting for 70-75% of human immunoglobulins (antibodies). IgG detoxifies harmful substances and is important in the recognition of antigen-antibody complexes by leukocytes and macrophages. IgG is transferred to the fetus through the placenta and protects the infant until its own immune system is functional.

Functions of IgG includes:

1. control infection of body tissues by binding many kinds of pathogens such as viruses, bacteria, and fungi,
2. IgG activates all the classical pathway of the complement system, a cascade of immune protein production that results in pathogen elimination;
3. IgG also binds and neutralizes toxins.
4. IgG are also involved in the regulation of allergic reactions.
5. IgG antibodies can prevent IgE mediated anaphylaxis by intercepting a specific antigen before it binds to mast cell–associated IgE.