Journal Wetenskap Health

The Reaction and Type of Hypersensitivity

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Abstract

The purpose of the study is to analyze the reaction and types of hypersensitivity. The study discusses the reaction of hypersensitivity occurs in individuals who have previously been exposed to an antigen that has created an immune response to it (sensitization). there are 4 groups of hypersensitivity reactions, namely Type I (anaphylactic reaction), type II (cytotoxic reaction), type III (immune complex reaction), type IV (slow type reaction). Hypersensitivity reactions can occur in two situations. first, the response to foreign antigens (microbes and non-infectious environmental antigens) which can cause tissue damage, especially if the reaction is repeated and uncontrolled. Second, the immune response can act directly against self-antigens (autologs) as a result of failure to tolerate self (self-tolerance).

Keywords: Hypersensitivit, Naphylactic, Cytotoxic, Immune Complex, Slow Type

Introduction

Basically, our bodies have natural immunity which is non-specific and specific immunity. Specific immunity is humoral immunity which is actively played by B lymphocyte cells, which produce 5 kinds of immunoglobins (IgG, IgA, IgM, IgD and IgE) and the cellular immunity system delivered by T lymphocytes, which when found with antigens then differentiate. and produce lymphokines, which regulate other cells to destroy these antigens. Whenever an allergen enters the body, the body will respond. When the allergen is destroyed, this is an advantage so that what happens is an immune state. However, when it harms the body tissue it becomes damaged, then there is a hypersensitivity or allergic reaction. According to Jung et al. (2012), The mechanism of an allergic reaction is based on a hypersensitivity reaction, namely the emergence of excessive IgE respin to substances considered to be allergens, resulting in the release of various mediators that cause allergic reactions, although in normal people this reaction does not occur. If this allergic reaction is excessive, anaphylactic shock can occur.

According to Templeton et al. (2012), Allergy or hypersensitivity is immune failure in which a person's body becomes hypersensitive in reacting immunologically to substances that are generally non-immunogenic. in other words, the human body overreacts to the environment or to substances the body deems foreign or dangerous. The substances that cause the hypersensitivity are called allergens. Based on the immunological reaction mechanism that occurs, there are 4 groups of hypersensitivity reactions, namely Type I (anaphylactic reaction), type II (cytotoxic reaction), type III (immune complex reaction), type IV (slow type reaction).

Definition af a Hypersensitivity Reaction

The concept that the immune system is needed to protect a host from infection is emphasized throughout this book. But the immune response itself is capable of causing tissue injury and disease (Abbas et al. 2019). Immune reactions that cause tissue injury or pathology

are called hypersensitivity reactions. The immune response to antigens causes sensitivity to the presence of these antigens, thus hypersensitivity antigens are a reflection of an excessive immune response. Nakae et al. (2002) stated, Hypersensitivity is an excessive antigenic response that occurs in individuals who have previously been sensitized to a particular antigen or allergen. If a person has been exposed to an antigen, and then is re-exposed a second time, it can cause an excessive or abnormal secondary immune response that can cause an adverse reaction, causing damage to the body's tissues. Hypersensitivity reactions are immune responses that are clearly injurious to the host (Weiss et al. 1990). This reaction occurs in individuals who have previously been exposed to an antigen that has created an immune response to it (sensitization). Bookman et al. (1997) stated Hypersensitivity reactions can occur in two situations. first, the response to foreign antigens (microbes and non-infectious environmental antigens) which can cause tissue damage, especially if the reaction is repeated and uncontrolled. Second, the immune response can act directly against self-antigens (autologs) as a result of failure to tolerate self (self-tolerance).

Hypersensitivity Reaction Type

Demoly et al. 1999). Based on the immunological reaction mechanism that occurs, Gell and Coomb divide hypersensitivity reactions into 4 groups, namely: (1)Type I (anaphylactic reaction) :Type I hypersensitivity reactions or anaphylactic reactions occur in a rapid time of between 2 -30 minutes after a person is re-exposed to the same antigen for the second or next time. Hypersensitivity reactions can occur when the number of antigens that enter is large enough or if a person's immune status, both cellular and humoral, increases. An important factor in the occurrence of anaphylactic reactions is IgE, which is a homocytotropic / regain antibody. In general, anaphylactic reactions are systemic, causing shock and respiratory failure, which are often fatal. In addition, anaphylactic reactions can also be local reactions including allergic reactions, including asthma and redness of the skin. IgE that is attached to mastocyte or basophil cells is produced by the body as a result of antigen stimulation, including snake venom or plant pollen. Mastocyte and basophil cells have about 500,000 sites where IgE attaches. If the IgE attached to the mastocyte is exposed to a specific allergen, the allergen will be bound by the IgE in such a way that the allergen forms a bridge or cross link between the two IgE molecules, which can stimulate degranulation in mastocytes or basophil cells so that they can release. a chemical mediator that stimulates a series of intracellular biochemical reactions in sequence. This series of reactions starts with the activation of the methyltransferase and serine esterase enzymes followed by the fusfatidyl inositol reaction to inositol triphosphate, the formation of diacylglycerol and an increase in intracytoplasmic Ca2 + ions. This biochemical reaction causes the formation of compounds that facilitate the fusion of granular membranes so that degranulation occurs which results in the release of chemical mediators, namely histamine, heparin, eosinophils, cemothactic factor, neutrophils, cemothactic factor, platelet activating factor, leukotrin and prostaglandins which can cause vasodilation, increased vascular permeability, narrowing of the bronchial tubes, edema of the mucosa and mucosal hypersecretion. Prausnitz and Kustner tried to explain the mechanism of the occurrence of an allergic reaction in 1921. They took a serum from Kustner who was allergic to fish and injected it into Prausnitz's skin. When the fish antigen is then injected into the sensitized area, a welt and red reaction occurs. Prausnitz and Kustner hypothesized the presence of an atopic reagent in the serum of allergy sufferers. 45 years later, Ishizaka et al succeeded in isolating this atopic reagent which turned out to be a new class of immunoglobulins which were later called IgE. Contact of an allergen with mucosa is followed by a complex sequence of events that produce IgE. IgE response is a local response that occurs at the site of entry of allergens into the body on the mucosal surface and / or lymph nodes.

- (2) Type II (cytotoxic reactions): Hypersensitivity type II reactions or cytotoxic reactions generally occur due to the activation of the complement system after being stimulated by the presence of the antigen antibody complex. The antibody antigen complex on the target cell surface will be destroyed due to complement activation as well as by other effector cells such as macrophages, lymphocytes, T-cytotoxic cells and NK cells. According to (Gleeson, 2006). The immune response mechanism, especially the cytolysis process by effector cells, describes the function of effector cells such as macrophages, T-cytootxic cells and NK cells in the face of pathogenic microbes. Most of the microorganisms are phagocytosed and killed intra-lysosomes, but this is difficult to do with large cells. Therefore, to overcome this problem, phagocyte cells and other effector cells release certain chemical mediators around them, such as proteases and collagenases to damage the target cells. Antibody Dependent Celluler Cytotoxicity (ADCC) mechanism of cytolysis, is a useful way to destroy large target cells. In addition, the cytolysis mechanism with the help of antibodies can destroy pathological cells such as tumor cells. However, this cytolytic reaction is sometimes detrimental if in certain circumstances the antibody can coat certain cells in the body so that the ADCC reaction will actually damage these cells. Some examples of type II hypersensitivity reactions are:(a) Reactions that occur in blood transfusions, (b) Hemolytic reactions in newborns due to rhesus factor, (c) Drug-induced hemolytic anemia and (d)Transplant tissue rejection reaction.
- (3) Type III (immune complex reactions) Hypersensitivity reaction type III is a reaction that involves antibodies to the antigen that dissolves and circulates in the serum. This is different from the type II hypersensitivity reaction which is aimed at antigens that are on the cell or cell surface. Long-term exposure to antigens can stimulate the formation of antibodies, especially the IgG group. The antibodies formed react with recognized antigens, forming antibody antigen complexes that can settle in one of the body's tissues. The formation of this antibody antigen complex will cause an inflammatory reaction. When the antibody antigen complex settles in the body's tissues, it will activate the complement system. Activation of complement can not only destroy the antigen antibody complex, but also can damage the surrounding tissue. The immune complex reaction depends on the relative ratio between the levels of antigen and antibody. If the antibody level is excessive, it will form an antibody antigen complex that can stimulate complement activation so that the antigen can be eliminated, whereas if the antigen level is excessive, the antibody antigen complex formed cannot activate the complement and does not cause an inflammatory reaction. However, if the levels of antigen antibodies are relatively the same, the immune complexes that are formed will quickly settle, causing local abnormalities in the form of severe infiltration of PMN cells, platelet aggregation and vasodilation, which causes irritation and edema (arthus reaction). Glomerulonephritis is an example of a disease caused by an immune complex reaction that can cause glomerular damage to the kidneys.
- (4) Type IV (slow reaction type) Hypersensitivity reaction type IV or hypersensitivity type slow is a reaction that involves a cellular immune response, especially by T cells. This reaction is slow and generally occurs more than 12 hours after exposure to the antigen. This is because the migration of T cells and macrophages to the presence of antigens takes time ranging from 12-24

hours. This slow type of hypersensitivity reaction occurs due to exposure to foreign antigens, especially in body tissues which are considered by phagocytic cells, namely macrophages which are then presented on T cells. mature and memory T cells. If a person is re-exposed to the same antigen, this type of slow hypersensitivity reaction will occur. Memory cells activate T cells to release lymphokine compounds that can damage antigens that interact with T cells. The most common manifestation of a type IV hypersensitivity reaction is a skin test for tuberculosis. As we know that mycobacterium tuberculosis is often in macrophages, so that these bacteria can cause a cellular immune response. For diagnosis, the protein component of mycobacterium tuberculosis is injected into the skin. Inflammatory reactions caused by injections into the skin. The inflammatory reaction caused by the injection of the antigen can be seen after 24-48 hours. Hypersensitivity reactions that take several hours or several days are called slow-type hypersensitivity reactions.

Conclusion

Hypersensitivity is an excessive antigenic response that occurs in individuals who have previously been sensitized to a particular antigen or allergen. If a person has been exposed to an antigen, and then is re-exposed a second time, it can cause an excessive or abnormal secondary immune response that can cause an adverse reaction, causing damage to the body's tissues. Hypersensitivity reactions are immune responses that are clearly injurious to the host. This reaction occurs in individuals who have previously been exposed to an antigen that has created an immune response to it (sensitization). Based on the immunological reaction mechanism that occurs, there are 4 groups of hypersensitivity reactions, namely Type I (anaphylactic reaction), type II (cytotoxic reaction), type III (immune complex reaction), type IV (slow type reaction).

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