

Introduction To Immunology: Part II- The Role Of And Problems With Vaccines

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This article is a follow up to an article in the last issue of "Quotes" entitled INTRODUCTION TO IMMUNOLOGY PART I - THE ROLE OF AND PROBLEMS WITH VACCINES . For those members who may not have seen that article, or who need a refresher on basic medical terminology, the following definitions are provided from Miller - Keane's Encyclopedia and Dictionary of Medicine and Nursing.

Antibody - a protein that is produced in the body in response to invasion by a foreign agent (antigen), and that reacts specifically with it. Antibodies are part of the body's natural defense against invasion by foreign substances. Each antibody is effective only against the particular antigen that stimulates its production.

Antigen - any substance not normally present in the body, which, when introduced into it, stimulates production of an antibody that reacts specifically with it. Antigens are almost always of protein composition; for example, the structures of bacteria and viruses and the toxins they elaborate are protein.

Immunity - resistance of the body to the effects of a harmful agent, such as pathogenic microorganisms (viruses and bacteria, for example) or their toxins (poison produced by living organisms). Immunity occurs as a result of the antigen-antibody reaction that takes place whenever a foreign agent or its product enters the bloodstream.

This article will focus on specific disorders of the immune system, such as allergies and hypersensitivity reactions. The body needs normal immune responses to protect itself against invasion by foreign organisms, tissues, and substances. Sometimes these usually protective responses have a detrimental effect on the host animal; all such adverse responses are known as allergies or hypersensitivities. An autoimmune disease is one in which the animal experiences disease due to immunologic action of its own cells or antibodies on components of its own body. There are four types of situations in which the animal's immune system damages its own tissues. These are described.

TYPE I REACTIONS OR ANAPHYLAXIS - During an acute anaphylactic reaction, the dog goes into shock due to circulatory collapse, and the reaction is immediate in nature. Symptoms may affect the respiratory system (inflammation of the mucous membrane of the nose, bronchial spasms, swelling of the larynx), gastrointestinal tract (nausea, cramps, vomiting, and diarrhea), cardiovascular system (dilation of the blood vessels of the liver and intestines -in dogs, this is the primary system attacked), and skin (hives, elevated itchy patches). One of the common drugs which can induce anaphylactic shock in sensitive animals is penicillin, which can be used as a preservative in some vaccines. Other antigens may be found in vaccines produced from eggs or tissue culture cells or other drugs. Anaphylactic shock can also occur after the ingestion of food or after insect bites. Clinical signs occur within seconds after the allergen enters the circulation. In severe cases, death is the outcome. Treatment requires prompt administration of intravenous adrenalin and oxygen, and support of blood pressure.

Type I reactions may also be more local in nature, as when the allergen

enters through the mucous membranes or the skin. Dogs can be beset by chronic allergic bronchitis, in which there is a dry, harsh, hacking cough easily provoked by exertion or by pressure on the trachea. The disease can be seasonal or year-round, and generally is not associated with other signs of illness. PIE syndrome is known to occur in dogs (pulmonary infiltration with eosinophilia - a type of blood cell that often occurs in excess in allergic states). The dogs are often short of breath or tire easily with exercise. Intestinal food allergies are also classified as Type I localized anaphylactic reactions. Please refer to the January, 1996 article in "Health Watch" on Recognition and Management of Chronic Bowel Disease for details. Atopic dermatitis is an itchy, chronic skin disorder, which is estimated to occur in 10% of all dogs; it is probably due to inhaled allergens such as pollens, mold, and danders. Dogs with this type of dermatitis often chew at their feet and axillae, and excessive sweating may be seen in hairless areas. Problems with the skin lesions are compounded by licking, scratching, and secondary bacterial infections.

TYPE II REACTIONS OR ANTIBODY-MEDIATED CYTOTOXICITY - Cytotoxic reactions are those which have a deleterious effect upon the cells. Antibodies that are produced by the body as part of the immune response such as IgG, IgM, or IgA bind to antigens on the surface of body cells or associated structures. Blood cells are particularly susceptible to immune-mediated destruction or envelopment by other living cells. In effect, the animal produces "autoantibodies" that react against its own tissues. The reason why this happens is not clear, but one theory has it that clones of autoantibody-producing cells are normally produced during an animal's lifetime, but are normally suppressed by lymphocytes (one of the colorless blood corpuscles capable of movement like amoeba, whose chief function is to protect the body against microorganisms). In some instances of autoimmune disorders, there seems to be a deficiency of suppressor lymphocytes. It is likely that many autoimmune disorders have a genetic predisposition. There is also evidence that acute viral infections may provoke temporary changes in the functioning of the immune system. Drugs, vaccinations, or infections also have been implicated in precipitating attacks. Postviral autoimmune hemolytic anemia (where red blood cells rupture and release hemoglobin into plasma) and thrombocytopenia (decrease in platelets in circulating blood) have occurred in man and sometimes in dogs, and they are the most common Type II reactions. Autoimmune hemolytic anemia (abbreviated AIHA) and thrombocytopenia can also be associated with systemic lupus erythematosus (SLE).

There are several other Type II diseases named in the literature which can affect dogs, such as Pure red cell aplasia, cold agglutinin (hemolytic) disease, and skin disorders such as pemphigus vulgaris, pemphigus foliaceus, and bullous pemphigoid. One other Type II disease, Myasthenia gravis (acquired form) has definitely been reported to occur in Cavaliers. Symptoms include extreme generalized muscle weakness, made more noticeable by mild exercise, and sometimes megaesophagus (which is the dilatation and enlargement of most of the esophagus). Myasthenia gravis can be treated with a long-acting anticholinesterase medication to decrease the effects of autoantibodies binding to receptor sites and reducing acetylcholine.

TYPE III REACTIONS OR IMMUNE COMPLEX DISEASE - These reactions are seen when antigen-antibody complexes localize in tissues, usually in vessel walls. Complexes of intermediate size cause the problems, as smaller complexes are soluble and pass through vessel walls, and larger complexes are removed by the reticuloendothelial system (a network of cells and tissues found throughout the body, especially in the blood, general connective tissue, spleen, liver, lungs, bone marrow, and lymph nodes).

There are quite a few conditions which can result in immune complex disease. These include: 1) Infections-chronic, persistent, low-grade, viral, bacterial, fungal, protozoal, or parasitic. 2) Malignancy-neoplasms (new growths). 3) "Autoimmune disorders" such as systemic lupus erythematosus (SLE). 4) Drug reactions-there are several drugs, such as erythromycin, lincomycin, sulfonamides,

trimethoprim-sulfonamide, and some hormones, which seem to precipitate immune complex diseases in a small portion of treated animals. 5) Serum sickness-the result of therapeutic use of serum from another source. 6) Unidentifiable antigen origin which creates disease.

The clinical signs and symptoms vary quite a bit. They include: glomerulonephritis (inflammation of the glomeruli in the kidney); synovitis (inflammation of a synovial membrane of a joint); pneumonitis (inflammation of lung tissue); dermal eruptions; vasculitis (inflammation of a vessel, usually small arteries); meningitis (inflammation of the membranes covering the brain and spinal cord); myopathy (muscle disease); neuropathy (any disease of the nervous system); or localized hemorrhages. In any one dog, immune complex disease may involve any one or a combination of the above major organ systems. They are among the most frequently occurring immunologic diseases.

TYPE IV REACTIONS OR CELL-MEDIATED IMMUNE REACTIONS AND DELAYED

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HYPERSENSITIVITY - This reaction is seen in people who are sensitive when given a tuberculin test by receiving an intradermal (within the skin) injection of a protein derivative of the bacteria responsible for TB. The type of reaction concentrates macrophage (large phagocytic cells which engulf others) at the site of the antigen invasion, which makes it extremely effective in combating many microbial infections. It can also be important in the destruction of some tumors and foreign-tissue grafts. Extensive granulomas (circumscribed masses consisting mainly of large phagocytic tissue, occurring in reaction to the presence of a living agent, a foreign body, or sometimes without an identifiable cause) are examples of persistent and uncontrolled Type IV reactions.

OTHER DISORDERS OF THE IMMUNE SYSTEM - There are other diseases related to disorders of the immune system, which tend to be classified as immune-deficiency diseases, tumors of the immune system, and gammopathies (conditions in which serum immunoglobulin levels are greatly increased). Many of these diseases can and do affect dogs. What they all share in common is an increased susceptibility to infections, many of which can develop as life-threatening complications on their own. Occasionally there is a failure of passive transfer of maternal antibodies. This can occur if the young fail to nurse properly during the early days of life, or if the dam's colostrum contains low levels of specific antibodies. Newborn animals that fail to receive adequate maternal antibodies are susceptible to fatal bacterial or viral infections of the gastrointestinal and respiratory systems. One disease worth noting is combined immunodeficiency disease, which is probably of autosomal recessive inheritance. Generally puppies with this disease appear to be normal until they are 6-12 weeks old, when the maternal antibodies are waning. The most frequently occurring cause of death is when the puppies develop canine distemper as a result of routine immunization with modified live virus distemper vaccine.

As always, when you notice any of the signs or symptoms listed throughout this article in your dog, or otherwise see indications that the animal is not behaving like him/herself, do not delay in seeking appropriate veterinary medical

treatment.

Disclaimer: Your veterinarian is the most qualified person to answer all of the questions you have about your pet's health. Nothing in this article should be construed as medical advice regarding any individual animal's condition.

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