Topic: Dysfunction of the Immune System

Define the following:

Hypersensitivity: occurs when the normal immune mechanisms produce exaggerated response to an antigen, or inappropriate response to self-antigens. There are 4 types

Alloimmunity: type of delayed hypersensitivity reaction caused by a reaction to antigens or transplanted cells from the same species. Can also occur in blood transplants, skin grafts, or in pregnancy.

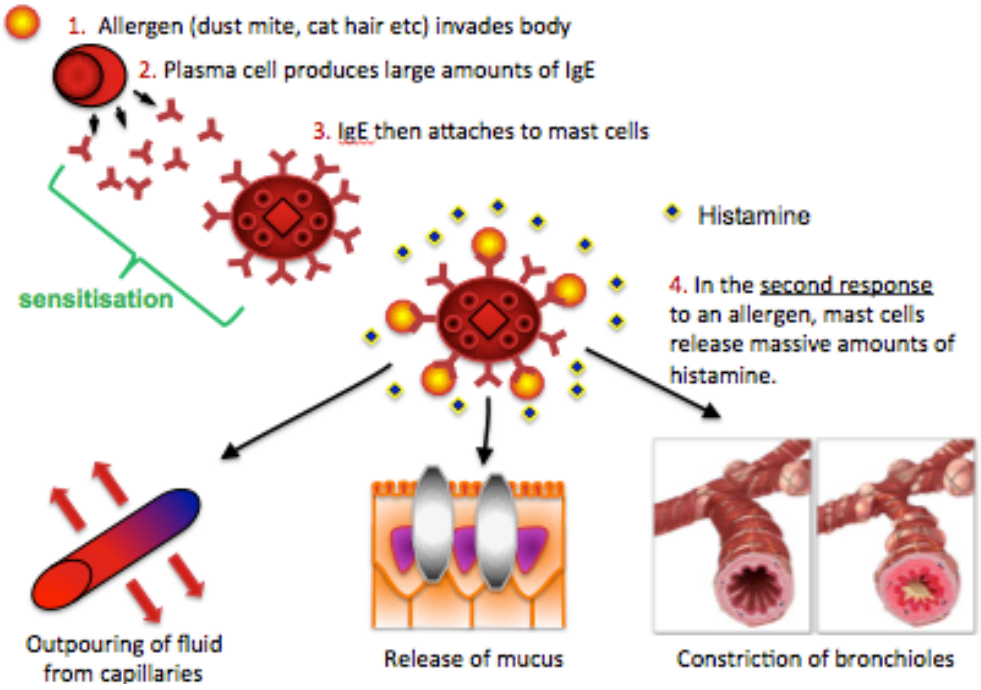
autoimmune disorder: where antibodies are produce to bind to normal cell receptors. Example of type 2 hypersensitivity.

Immunodeficiency: a state where the immune system is defective/missing/compromised by disease – unable to respond appropriately. Classified by primary (mostly genetic aetiology) and secondary (extrinsic factors) – both leave the body unable to fend off infection.

What are the four types of hypersensitivity? Provide an example of each.

- Type 1: Immediate hypersensitivity – mediated by production of IGE antibodies from exposure to antigens or haptens. Clinical signs: varies from mild rashes to life-threatening anaphylactic reactions, increased mucous production, swelling of epithelial tissue, bronchoconstriction.
    - Examples: hay fever, hives, atopic dermatitis
- Type 2: antibody-dependent cytotoxic hypersensitivity – mediated by IgG or IgM antibody production. These binding antibodies activates a-d-c-h to destroy cells (protein receptors) which disrupts normal function by causing uncontrolled activation by blocking receptor function.
    - Examples: graves disease,
- Type 3: immune complex mediated hypersensitivity – when unattached antigens enter the blood circulation which exaggerates immune response = formation of large antigen-antibody complexes – builds up in capillaries/joints/glomeruli of kidneys.
    - Example: rheumatic fever, Rheumatoid arthritis
- Type 4: cell mediated – mediated by immune cells rather than requiring antibodies known as delayed hypersensitivity.
    - Example: contact dermatitis

In a flow diagram, outline the pathogenesis of type I hypersensitivity (using an asthmatic trigger as an example).



How does adrenaline reduce the signs and symptoms in patients suffering from anaphylactic shock?

- Anaphylactic shock signs/symptoms: systematic response to inflammatory mediators released in type 1 hypersensitivity.
- In medical emergencies anaphylaxis is treated with adrenaline and saline to restore blood pressure
    - Adrenaline stimulates alpha-adrenergic receptors (decreases vascular permeability > vasodilation), activates beta-2-adrenegeric receptors (relaxes smooth muscle > relieves bronchospasms/airway resistance), increases production of cyclic adenosine 3’5’-monophosphate (c-amp) [release of immediate hypersensitivity from cells].
- Signs/Symptoms: tachycardia, confusion, loss of consciousness, rashes, localised oedema.

Differentiate between Type I hypersensitivity and type IV hypersensitivity responses to contact with an antigen.

- Type 1-3: antibody mediated. Type 1 produces IgE antibodies causing the release of vasoactive amines/mediators from mast cells > inflammation
- Type 4: cell mediated. Upon contact with an antigen, t cells activate causing the release of cytokines – inflammation and macrophage activation, and cell mediated toxicity

Outline the pathogenesis of HIV infection to the development of AIDS. In your answer be sure to include the critical cellular changes that occur following HIV infection and the overall effects of these changes to immune system function over time.

- HIV (human immunodeficiency virus) is a retrovirus and is the infection of CD4 positive T helper (h) cells which can manifest to AIDs (Acquired immunodeficiency syndrome). Loss of T (h) cells = inactivation of cell mediated immunity.
    - HIV1: virion + viral envelope makes up the outer lipid bilayer of host cell > embeds glycoproteins composed of transmembrane gp41/gp120 binds to CD4. Viral genome consists of 2 single strands of RNA, RT molecules and enzymes.
- HIV enters T (h) cell > reverse transcriptase = viral RNA > integrated into host cell genome via integrase enzyme > new viral RNA is translated > co-ordinates production of new virions > host cell is lysed
    - HIV therapy: fusion inhibitors, reverse transcription inhibitors, integrase inhibitors, protease inhibitors.
- Pathogenesis: acquired immunodeficiency from AIDs occurs over 3 years. Infection stage > asymptomatic stage > period of immune deficiency (fatal) from opportunistic pathogens. Progression to AIDs occurs as HIV viral evolution to allow more infection of CD4 +ive T cells === results in immune deficiency.