Lecture 1

PG sem - III
CC 10
Unit - V (S-1)

Hypersensitivity (Type I, II, III and IV)

Hypersensitivity reactions are associated with immune responses induced by antigens. This depends on recognition of molecular components of antigen bearing pathogens from those of hosts (man or animals) as foreign. A variety of food is eaten by living organisms but they do not develop any immune responses and hypersensitivity reactions. But some times they cause over reaction of immune system called hypersensitivity reaction or allergy.

Frank Austen has studied allergy and anaphylaxis and called the less inflammatory reactions caused by mast cells as Type I hypersensitivity. Robin coombs and Philip Gell (1975) divided the hypersensitivity reactions into 5 groups Type I, II and III are hypersensitivity reaction mediated by humoral immunity involving B cells and antibodies. Type IV is accomplished by cell mediated immunity, involving T cells. Type IV hypersensitivity reactions takes longer time hence it is called as delayed type of hypersensitivity reaction Type V HS reaction is stimulatory HS mediated by hormonal activity.

1 Type Hypersensitivity reaction. Most of the allergic reactions occur due to type I hypersensitivity. The reactions occur due to binding of antigen to antigen specific immunoglobulin-E (IgE) bound to its Fc receptors chiefly on mast cells. This reaction is induced by inhaled allergens such as mold spores, faeces of house dust mites, Pollen grains of plants hair, dealp, some flakes of dead animal cells. The above reactions causes running of nose, difficulty in breathing and in severe cases asphyxiation leading to death.

various aspects of

Type I hypersensitivity reaction would comprise
(i) Response of IgE antibodies to antigens.
ii) Role of IgE receptors
iii) Response of mast cells to antigens
iv) clinical aspects of type I hypersensitivity reactions.
v) Genetic control of type I hypersensitivity.
(vi) Mediators of Type I HS.
(vii) Consequences of Type HS.
(viii) Diagnosis of Type I HS.
ix Treatment and prevention of type I Hs.

" The Type I hypersensitivity reactions involve response of IgE antibodies, cytokines, mast cells basophils and eosinophil cells along with various clinical manifestations. Type I reactions are also called as immediate hypersensitivity reaction. It is induced by certain type of antigen, ~~reff~~ referred as allergens. The allergens induces humoral antibody response IgE binds with high affinity Fc receptors on the surface of tissue mast and basophils. Such IgE coated mast cells and basophils are sensitized. A later exposure to the same allergen cross links the membrane bound IgE on sensitised mast cells and basophils causing degranulation of these cells. The Pharmacologically active mediators released from the granules act on the surrounding tissues

Common Allergen Associated with Type I Reaction
1) Proteins - foreign Serum, Vaccines
2) Plant Pollens Rye grass, ragweed, timothy grass, birch trees.
3) Drugs Penicillin, Sulfonamides, local anaesthetics, Salicylates.

Food - nuts, Seafood, eggs, Peas, beans, milk
Insect Products - bee venom, wasp venom, ant venom, Cockroach calyx dust mites Mold Spores, animal hair and dander.

Mechanism of Action -

1) Receptor cross linkage
2) Intracellular events leading to mast cell degranulation.

Non IgE Antibody Related Initiators of Type I Hypersensitivity.

Complement Activation products
C3a, C4a, C5a Anaphylatoxin

various Drugs :- ACTH, Codeine, Morphine Penicillin

Mediators of Type I Hypersensitivity
Stored in mast cell Granules
Histamine, Heparin and Serotonin
Permeability → Increased vascular
Smooth Muscle Contraction
Chemotactic factors
Eosinophils and Neutrophils Attract Eosinophils & Neutrophil

Proteases - Degrade Basement membrane of blood vessels, Activate bronchial mucous Secretion, Activate complement

Secondary Mediators of Type I Hypersensitivity -

Synthesized and Released After Mast cell Activation

Platelet Activating factor — Platelet Aggregation & Smooth muscle contraction

Degranulation

Prostaglandins — vasodilation, smooth muscle contraction

Leukotrienes (SRS-A) — Increased vascular Permeability Pulmonary smooth muscle contraction

Bradykinin — Increased vascular Permeability Smooth muscle contraction.

Cytokines — Systemic Anaphylaxis
Altered cell adhesion

Detection of type I hypersensitivity
Radioimmunosorbent test (RIST), ~~quant~~ quantify Nano gram amounts of total Serum IgE
Radioallergosorbent test (RAST) quantify Nano gram amounts of Serum IgE Specific for a particular allergen

To treat- Type I immediate Hypersensitivity Based on the underlying Mechanisms

1) Block effects of Primary mediators on target cells (eg respiratory smooth muscle or Vascular epithelium)
Anti histamine, Cortisone
2) Block calcium ion Influx Cromolyn
3) Block the effects of Calcium Ion influx & Keep cyclic AMP (cAMP) from Falling Theophylline
4) Increase Production of cAMP (Adrenaline epinephrine)

Dr Bible Verma
Dept of Zoology.