

Hypersensitivity reactions

Hypersensitivity refers to undesirable reactions produced by the normal immune system

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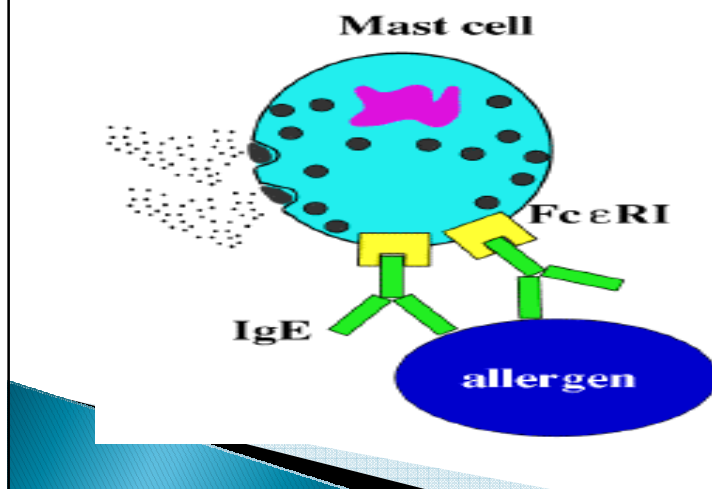
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Hypersensitivity reactions

- ▶ Type I
 - Allergy (immediate)
- ▶ Type II
 - cytotoxic , antibody-dependent
- ▶ Type III
 - Immune complex diseases
- ▶ Type IV
 - Delayed type , cell mediated

TYPE I hypersensitivity (anaphylactic)

Type I hypersensitivity



TYPE I hypersensitivity (anaphylactic)

▶ MECHANISM

1. the allergen stimulates the induction of $cd4^+$ T cells. These T cells secrete cytokines that cause IgE production by plasma cells.
- ▶ 2. The IgE molecule will bind to Fc receptor on mast cell and basophils which in turn causes vasodilation, increased vascular permeability and vascular spasm.

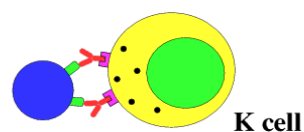
TYPE I hypersensitivity (anaphylactic)

- ▶ this type may occur as systemic or local reaction:
 - A) systemic reactions: skin erythema, followed by respiratory difficulty due to bronchial constriction.
 - B) local reactions: generally on skin or mucosal surface at site of Ag exposure.
- ▶ Allergy to penicillin, Aspergillus spores, rupture of Echinococcus cyst...

TYPE II HYPERSENSITIVITY (antibody dependent)

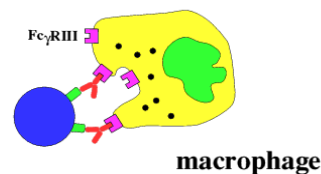
- ▶ in this type Ab are formed against target Ag that are cell membrane components.

Type II Hypersensitivity



K cell

Antibody dependent cell cytotoxicity



macrophage

TYPE II HYPERSENSITIVITY (antibody dependent)

- ▶ Not really hypersensitivity, but cytotoxic reactions:
- ▶ A) Complement-mediated:
 - ab reacts with cell surface Ag leading to fixation of complement system and then cell lysis . e .g ; red cells are the most common cells damaged by this mechanism>>>HEMOLYTIC ANEMIA

NO MICROBES!

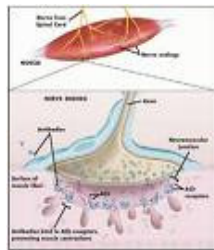


TYPE II HYPERSENSITIVITY (antibody dependent)

- ▶ B) many cell types (macrophages, neutrophils, NK cells) cause lysis of target cell coated by IgG
 - Poststreptococcal rheumatic fever:
 - molecular mimikri: Antibodies produced against *S. pyogenes* cross react with various tissue eg. heart, joints – inflammation
 - *Oncocerca* worm infection may lead to blindness because of the cross reaction of Ab produced against to pathogen and proteins of retina

TYPE II HYPERSENSITIVITY (antibody dependent)

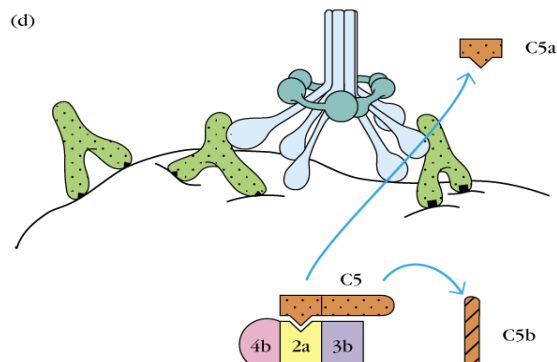
- ▶ C) Antibody-mediated cellular dysfunction
 - in some cases Ab is directed against cell surface receptor impairing the function but not cause cell injury>>>MYASTHENIA GRAVIS ; Ab reacts with ach receptors on motor end plate.



NO MICROBES!

TYPE III HYPERSENSITIVITY (immune complex mediated)

- ▶ this type is mediated by ag-ab complexes which initiate an inflammatory reaction in the tissue.



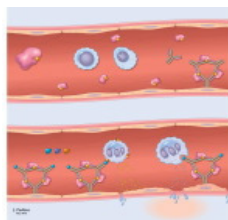
TYPE III HYPERSENSITIVITY (immune complex mediated)

- ▶ there are 2 pattern of immune-complex mediated injury:
- ▶ A) SYSTEMIC DISEASE (serum sickness type, SLE)
 - this is because of large excess of Ab and immune complexes are deposited at site of injury specially within vessel wall , the subsequent events will result in necrotizing vasculitides and accumulation of neutrophils>>>SLE



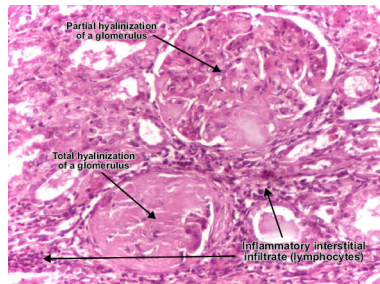
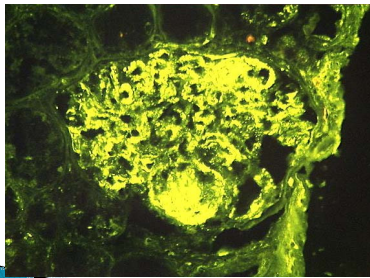
TYPE III HYPERSENSITIVITY (immune complex mediated)

- ▶ B) LOCAL DISEASE (arthus reaction)
 - Arthus reaction:
 - intracutan injection of antigens to a presensitized person may lead to local intradermal Ab – Ag complex formation and local vasculitis, redness, swelling.
Example: Repeated (booster) vaccination with diphtheria or tetanus rarely lead to local vasculitis.



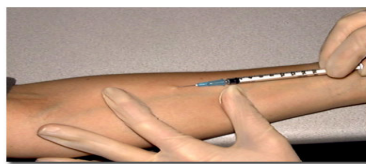
TYPE III HYPERSENSITIVITY (immune complex mediated)

- ▶ **Poststreptococcal acute glomerulonephritis:**
Ab-ag complexes deposite in glomeruli
- ▶ **HBV infection:** HBsAg-Ab complexes may also cause acute glomerulonephritis



TYPE IV HYPERSENSITIVITY (cell mediated)

- ▶ this is mediated by T-cells. There are 2 types involves CD4/8+T Cells.
 - A) Acute (within 2-3 days):
tuberculin test, contact dermatitis
 - :mediated by CD4+ T helper cells
 - cd4+ cells recognize ag (tuberculin),this leads to formation of sensitized cd4+ cells . Upon cutaneous injection into previous sensitized individual sensitized cd4+cells become activated and secrete cytokines.



TYPE IV HYPERSENSITIVITY (cell mediated)

- ▶ **Tuberculin/Mantoux test:** intradermal injection of tuberculin = purified tuberculo protein leads to swelling after 48–72 h if the patient have been exposed to *Mycobacterium tuberculosis* previously. Important: BCG vaccination? Yes/No!



TYPE IV HYPERSENSITIVITY (cell mediated)

- ▶ B) chronic (> 1 week):
granuloma formation, graft rejection :
 - mediated by cd8+ cytotoxic Tcell
 - lymphocytes surrounding epitheloid cells lead to formation of granuloma



SUMMARY

Type	Alternative names	Often mentioned disorders	Mediators
I	Allergy (immediate)	<ul style="list-style-type: none"> •Atopy •Anaphylaxis •Asthma 	•IgE
II	Cytotoxic, antibody-dependent	<ul style="list-style-type: none"> •Autoimmune hemolytic anemia •Thrombocytopenia •Erythroblastosis fetalis •Goodpasture's syndrome 	<ul style="list-style-type: none"> •IgM or IgG •(Complement)
III	Immune complex disease	<ul style="list-style-type: none"> •Serum sickness •Arthus reaction •Systemic lupus erythematosus (SLE) 	<ul style="list-style-type: none"> •IgG •(Complement)
IV	Delayed-type hypersensitivity (DTH), cell-mediated immune memory response, antibody-independent	<ul style="list-style-type: none"> •Contact dermatitis •Mantoux test •Chronic transplant rejection •Multiple sclerosis 	•T-cells