

## SUMMARY TOPIC: HYPERSENSITIVITY REACTION

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### Definition

Hypersensitivity refers to undesirable immune reactions (allergy, autoimmunity) that can be damaging, uncomfortable, or fatal.

### Classification of Hypersensitivity Reactions (Gell and Coombs)

| Type | Mechanism               | Key Players                  | Examples                            |
|------|-------------------------|------------------------------|-------------------------------------|
| I    | Immediate/Anaphylactic  | IgE, Mast cells              | Asthma, Allergy, Anaphylaxis        |
| II   | Antibody-mediated       | IgG, IgM, Complement         | Hemolytic anemia, Myasthenia gravis |
| III  | Immune complex-mediated | Immune complexes, Complement | SLE, Serum sickness                 |
| IV   | Delayed (Cell-mediated) | T cells, Macrophages         | TB, Contact dermatitis              |

#### Type I: Immediate (Anaphylactic)

- Phases: Immediate (minutes) & Late (hours to days)
- Mediators: Histamine, leukotrienes, prostaglandins
- Th2 cells → IL-4, IL-5, IL-13 → IgE production & eosinophil activation
- Examples: Urticaria, hay fever, asthma, systemic anaphylaxis
- Diagnosis: Skin prick test, IgE levels, provocation tests

#### Type II: Antibody-Mediated

- Mechanisms:
- Opsonization & phagocytosis
- ADCC (NK cells, eosinophils)
- Receptor dysfunction (agonist/antagonist)
- Examples:
- Hemolytic disease of the newborn
- Autoimmune hemolytic anemia
- Graves' disease, Myasthenia gravis
- Diagnosis: Coombs test, antibody panels, TSH/TFT

#### Type III: Immune Complex-Mediated

- Mechanism: Circulating immune complexes deposit in tissues → activate complement → inflammation
- Sites: Glomeruli, joints, vessels (high pressure areas)
- Examples:
- Systemic: Serum sickness, SLE, PSGN
- Local: Arthus reaction (localized vasculitis)
- Morphology: Vasculitis, neutrophilic infiltrates, fibrinoid necrosis

#### Type IV: T Cell-Mediated (Delayed)

- Mechanism:
- Sensitization phase: APC presents antigen → activates Th1/Th17
- Effector phase: Cytokines (IFN- $\gamma$ , TNF) → macrophage activation → tissue damage
- Examples:
- Tuberculin reaction
- Granulomas in TB
- Contact dermatitis (nickel, cosmetics)
- Drug hypersensitivities

- Autoimmune diseases (RA, MS, IBD)

#### References

- Robbins and Cotran, 10th ed.

