UNIT – 3 **I** PATHOPHYSIOLOGY

POINTS TO BE COVERED IN THIS TOPIC

- ➤ HAEMATOLOGICAL DISEASES ▲
- ➤ ENDOCRINE SYSTEM DISORDERS 🔬



➤ NERVOUS SYSTEM DISORDERS ●



➤ GASTROINTESTINAL SYSTEM DISORDERS ||

HAEMATOLOGICAL DISEASES



INTRODUCTION []]

Haematological diseases are disorders that affect the blood, bloodforming organs, and the blood's ability to function properly. These conditions can involve red blood cells, white blood cells, platelets, plasma, bone marrow, lymph nodes, spleen, and the proteins involved in bleeding and clotting.

IRON DEFICIENCY ANEMIA +



Iron deficiency anemia is the most common type of anemia worldwide, occurring when the body lacks sufficient iron to produce healthy red blood cells.

PATHOPHYSIOLOGY 🔬



Iron is essential for hemoglobin synthesis. When iron stores are depleted, the body cannot produce adequate healthy red blood cells, leading to decreased oxygen-carrying capacity.

ETIOLOGY 6

- Blood loss Menstrual bleeding, gastrointestinal bleeding
- Inadequate iron intake Poor dietary habits, vegetarian diet without supplementation
- Malabsorption Celiac disease, gastric surgery
- Increased iron requirements Pregnancy, growth periods

CLINICAL MANIFESTATIONS

- Fatigue and weakness
- Pallor of skin and mucous membranes
- Shortness of breath
- Cold hands and feet
- Brittle or spoon-shaped nails
- Unusual cravings for non-food items

MEGALOBLASTIC ANEMIA 🧈

Megaloblastic anemia is characterized by the production of abnormally large, immature red blood cells due to deficiency of vitamin B12 or folic acid.

VITAMIN B12 DEFICIENCY

PATHOPHYSIOLOGY

Vitamin B12 is essential for DNA synthesis. Its deficiency leads to impaired DNA replication, resulting in megaloblastic changes in rapidly dividing cells.

ETIOLOGY

- Pernicious anemia Autoimmune destruction of intrinsic factor
- Dietary deficiency Strict vegetarian diet
- Malabsorption Crohn's disease, gastric surgery
- Medications Proton pump inhibitors, metformin

CLINICAL MANIFESTATIONS

- Megaloblastic anemia symptoms
- Neurological symptoms peripheral neuropathy, subacute combined degeneration
- Glossitis and oral ulcers
- Mild jaundice

FOLIC ACID DEFICIENCY

PATHOPHYSIOLOGY

Folate is crucial for DNA synthesis and cell division. Deficiency results in megaloblastic anemia without neurological complications.

ETIOLOGY

• Dietary deficiency - Poor intake of leafy vegetables

- Malabsorption Celiac disease, tropical sprue
- Increased requirements Pregnancy, hemolytic anemia
- Medications Methotrexate, anticonvulsants

SICKLE CELL ANEMIA

Sickle cell anemia is a hereditary hemolytic anemia caused by a mutation in the beta-globin gene.

PATHOPHYSIOLOGY 🔬

The mutation causes substitution of valine for glutamic acid in the betaglobin chain, producing hemoglobin S. Under low oxygen conditions, red blood cells become rigid and sickle-shaped, leading to vaso-occlusion and hemolysis.

CLINICAL MANIFESTATIONS

- Vaso-occlusive crises Severe pain episodes
- Acute chest syndrome Pulmonary complications
- Stroke Due to cerebrovascular occlusion
- Chronic organ damage Kidney, liver, spleen
- Growth retardation In children

THALASSEMIA 🦑

Thalassemia is a group of inherited blood disorders characterized by reduced or absent production of globin chains.

TYPES 📊

Туре	Affected Chain	Severity	Clinical Features	
Alpha Thalassemia	Alpha globin	Variable	Mild to severe anemia	
Beta Thalassemia	Beta globin	Variable Transfusion-dependent anemia		
Beta Thalassemia	Beta globin Severe		Growth retardation,	
Major	Beta globin	Severe	hepatosplenomegaly	
Beta Thalassemia	Beta globin Mild		Mild anemia, usually	
Minor	beta globin	IVIIIU	asymptomatic	
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PATHOPHYSIOLOGY &

Imbalanced globin chain production leads to precipitation of excess chains, causing ineffective erythropoiesis and hemolysis.

HEREDITARY AND ACQUIRED ANEMIA

HEREDITARY ANEMIA 🦑

- Hereditary spherocytosis Membrane defects causing spherical red cells
- G6PD deficiency Enzyme deficiency causing hemolysis under oxidative stress
- Pyruvate kinase deficiency Metabolic defect in glycolytic pathway

ACQUIRED ANEMIA

- Autoimmune hemolytic anemia Antibody-mediated red cell destruction
- Microangiopathic hemolytic anemia Mechanical destruction in small vessels
- Drug-induced hemolytic anemia Medication-related hemolysis

HEMOPHILIA



Hemophilia is a group of inherited bleeding disorders caused by deficiency of specific clotting factors.

TYPES

- Hemophilia A Factor VIII deficiency (most common)
- Hemophilia B Factor IX deficiency (Christmas disease)
- Hemophilia C Factor XI deficiency (rare)

PATHOPHYSIOLOGY 🔬

Deficiency of clotting factors leads to impaired coagulation cascade, resulting in prolonged bleeding and poor clot formation.

- Hemarthrosis Joint bleeding, most common
- Muscle hematomas Deep muscle bleeding
- Prolonged bleeding After trauma or surgery
- Intracranial hemorrhage Life-threatening complication

ENDOCRINE SYSTEM DISORDERS 🔬



DIABETES MELLITUS



Diabetes mellitus is a group of metabolic disorders characterized by chronic hyperglycemia due to defects in insulin secretion, action, or both.

TYPES 📊

Туре	Pathophysiology	Age of Onset	Treatment	
Type 1	Autoimmune beta cell	Childhood/Young	Insulin therapy	
71	destruction	adult		
Type 2	Insulin resistance + beta cell dysfunction Adult onset		Lifestyle +	
			medications	
Gestational	Insulin resistance during	Dragnana	Diet + insulin if	
	pregnancy	Pregnancy	needed	

TYPE 1 DIABETES 6

PATHOPHYSIOLOGY

Autoimmune destruction of pancreatic beta cells leads to absolute insulin deficiency. Genetic susceptibility and environmental triggers initiate the autoimmune process.

- Classic triad Polyuria, polydipsia, polyphagia
- Weight loss Despite increased appetite
- Diabetic ketoacidosis Life-threatening acute complication

• Rapid onset - Symptoms develop over weeks

TYPE 2 DIABETES 📴

PATHOPHYSIOLOGY

Progressive insulin resistance combined with relative insulin deficiency. Initially, beta cells compensate by increasing insulin production, but eventually fail to maintain normal glucose levels.

CLINICAL MANIFESTATIONS

- Gradual onset Often asymptomatic initially
- Obesity Central obesity common
- Acanthosis nigricans Dark skin patches
- Recurrent infections Particularly fungal

COMPLICATIONS

- Acute complications Diabetic ketoacidosis, hyperosmolar hyperglycemic state
- Chronic complications Diabetic retinopathy, nephropathy, neuropathy
- Macrovascular complications Coronary artery disease, stroke, peripheral vascular disease

THYROID DISEASES 🧱



PATHOPHYSIOLOGY

Excessive production and release of thyroid hormones (T3 and T4) leading to increased metabolic rate and sympathetic nervous system activation.

ETIOLOGY

- Graves' disease Most common cause, autoimmune
- Toxic multinodular goiter Autonomous thyroid nodules
- Toxic adenoma Single hyperfunctioning nodule
- Thyroiditis Inflammation causing hormone release

CLINICAL MANIFESTATIONS

- Hypermetabolism Weight loss, heat intolerance, increased appetite
- Cardiovascular Tachycardia, palpitations, atrial fibrillation
- Neurological Anxiety, tremor, insomnia
- Ocular Exophthalmos in Graves' disease

HYPOTHYROIDISM U

PATHOPHYSIOLOGY

Decreased production of thyroid hormones leading to reduced metabolic rate and decreased sympathetic activity.

ETIOLOGY

- Hashimoto's thyroiditis Most common cause, autoimmune
- **lodine deficiency** Endemic goiter

- Post-surgical After thyroidectomy
- Medications Lithium, amiodarone

CLINICAL MANIFESTATIONS

- Hypometabolism Weight gain, cold intolerance, fatigue
- Cardiovascular Bradycardia, decreased cardiac output
- Neurological Depression, memory impairment, slowness
- **Dermatological** Dry skin, hair loss, myxedema

DISORDERS OF SEX HORMONES ******

MALE HYPOGONADISM 👵

PATHOPHYSIOLOGY

Decreased testosterone production due to testicular dysfunction (primary) or hypothalamic-pituitary dysfunction (secondary).

CLINICAL MANIFESTATIONS

- **Decreased libido** Reduced sexual drive
- **Erectile dysfunction** Impaired sexual performance
- Muscle weakness Decreased muscle mass and strength
- Osteoporosis Increased fracture risk
- Mood changes Depression, irritability

FEMALE REPRODUCTIVE DISORDERS



POLYCYSTIC OVARY SYNDROME (PCOS)

Pathophysiology: Insulin resistance and hyperandrogenism leading to anovulation and metabolic dysfunction.

Clinical Manifestations:

- Irregular menstrual cycles
- Hirsutism and acne
- Obesity and insulin resistance
- Infertility

MENOPAUSE

Pathophysiology: Natural decline in ovarian estrogen production with aging.

Clinical Manifestations:

- Hot flashes and night sweats
- Vaginal dryness
- Mood changes
- Osteoporosis risk

NERVOUS SYSTEM DISORDERS

EPILEPSY 4



Epilepsy is a neurological disorder characterized by recurrent, unprovoked seizures due to abnormal electrical activity in the brain.

PATHOPHYSIOLOGY 💰

Seizures result from excessive, synchronous neuronal discharge. This can occur due to imbalance between excitatory and inhibitory neurotransmission.

CLASSIFICATION

- LASSII ICATION
- Focal seizures Originate from specific brain region
- Generalized seizures Involve both cerebral hemispheres
- Unknown onset seizures Cannot be classified as focal or generalized

TYPES OF SEIZURES

Туре	Characteristics	Duration	Post-ictal State
Tonic-Clonic	Stiffening followed by jerking	1-3 minutes	Confusion, fatigue
Absence	Brief loss of awareness	5-30 seconds	Minimal
Myoclonic	Brief muscle jerks	Seconds	None
Atonic	Sudden loss of muscle tone	Seconds	Brief
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PARKINSON'S DISEASE

Parkinson's disease is a progressive neurodegenerative disorder affecting movement control.

PATHOPHYSIOLOGY 🔬

Progressive loss of dopaminergic neurons in the substantia nigra leads to decreased dopamine in the striatum, causing motor symptoms.

CLINICAL MANIFESTATIONS

- Motor symptoms:
 - Bradykinesia (slowness of movement)
 - Resting tremor
 - Rigidity
 - Postural instability
- Non-motor symptoms:
 - Depression and anxiety
 - Sleep disorders
 - Autonomic dysfunction
 - Cognitive impairment

STROKE **4**

Stroke is acute neurological dysfunction due to cerebrovascular disease.

TYPES 📊

- Ischemic stroke (85%) Blocked blood flow to brain
- Hemorrhagic stroke (15%) Bleeding in brain tissue

PATHOPHYSIOLOGY 🔬

Ischemic Stroke

Arterial occlusion leads to reduced cerebral blood flow, causing cellular energy failure and eventual cell death if not restored promptly.

Hemorrhagic Stroke

Bleeding into brain tissue increases intracranial pressure and directly damages neurons through mass effect and toxic blood products.

CLINICAL MANIFESTATIONS

- **Sudden onset** Symptoms appear rapidly
- Focal neurological deficits Weakness, speech problems, visual changes
- FAST signs Facial drooping, arm weakness, speech difficulty, time critical

PSYCHIATRIC DISORDERS



DEPRESSION 😂

PATHOPHYSIOLOGY

Depression involves dysregulation of neurotransmitter systems, particularly serotonin, norepinephrine, and dopamine.

- Mood symptoms Persistent sadness, anhedonia
- Cognitive symptoms Difficulty concentrating, memory problems
- Physical symptoms Fatigue, sleep disturbances, appetite changes
- **Behavioral symptoms** Social withdrawal, reduced activity

SCHIZOPHRENIA 🥞

PATHOPHYSIOLOGY

Complex disorder involving dopamine dysregulation, particularly hyperactivity in mesolimbic pathway and hypoactivity in mesocortical pathway.

CLINICAL MANIFESTATIONS

- Positive symptoms Hallucinations, delusions, disorganized speech
- Negative symptoms Flat affect, social withdrawal, poor motivation
- Cognitive symptoms Impaired working memory, attention deficits

ALZHEIMER'S DISEASE

PATHOPHYSIOLOGY

Progressive accumulation of amyloid plaques and neurofibrillary tangles leading to neuronal loss and brain atrophy.

- Early stage Mild memory loss, word-finding difficulties
- Middle stage Moderate cognitive impairment, behavioral changes
- Late stage Severe cognitive decline, loss of independence

GASTROINTESTINAL SYSTEM DISORDERS



PEPTIC ULCER DISEASE



Peptic ulcer disease involves mucosal breaks in the stomach or duodenum that extend through the muscularis mucosa.

PATHOPHYSIOLOGY 🔬



Peptic ulcers result from imbalance between aggressive factors (acid, pepsin, H. pylori) and protective factors (mucus, bicarbonate, prostaglandins).

ETIOLOGY 6

- Helicobacter pylori infection Most common cause (60-90%)
- NSAIDs Inhibit prostaglandin synthesis
- Zollinger-Ellison syndrome Excessive acid production
- Stress Physical stress, burns, surgery

TYPES



Location	Characteristics	Pain Pattern	Complications
Duodenal	More common	Pain 2-3 hours after meals	Perforation, bleeding
Gastric	Less common	Pain during or after meals	Malignancy risk
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- Epigastric pain Burning or gnawing sensation
- Dyspepsia Bloating, early satiety

- Nausea and vomiting Especially with gastric ulcers
- Weight loss More common with gastric ulcers

COMPLICATIONS 1

- Hemorrhage Most common complication
- Perforation Life-threatening emergency
- Penetration Ulcer extends into adjacent organ
- Gastric outlet obstruction Due to edema or scarring

DIAGNOSTIC APPROACH Q

- Upper endoscopy Direct visualization, gold standard
- H. pylori testing Urea breath test, stool antigen
- Upper GI series Barium contrast study
- CT scan For suspected complications

MANAGEMENT PRINCIPLES



- H. pylori eradication Triple or quadruple therapy
- Acid suppression Proton pump inhibitors
- NSAID discontinuation If possible
- Lifestyle modifications Diet, smoking cessation

SUMMARY



This unit covers major pathophysiological conditions affecting four important body systems:

Haematological diseases encompass various disorders affecting blood cells and clotting mechanisms, from nutritional deficiencies to genetic disorders.

Endocrine disorders involve hormonal imbalances affecting metabolism, growth, and reproduction, with diabetes and thyroid diseases being most prevalent.

Nervous system disorders include both acute conditions like stroke and chronic degenerative diseases like Parkinson's and Alzheimer's disease.

Gastrointestinal disorders, particularly peptic ulcer disease, demonstrate the complex interaction between infectious agents, medications, and physiological factors in disease development.