Pathology of Blood and Urine

Clinical Pathology Overview

- Clinical pathology involves the analysis of bodily fluids, primarily blood and urine, to diagnose diseases.
- **It helps in assessing:**
  - Physiological functions of the organs
  - Presence of infections or abnormalities
  - Overall health status

Pathology of Blood

Definition:

➢ The pathology of blood involves the study of abnormalities in blood cells (RBCs, WBCs, platelets), plasma proteins, and clotting factors, which may indicate systemic or hematologic diseases.

Common Hematological Disorders:

1. **Anemias** – reduction in RBCs or hemoglobin.
2. **Leukemias** – malignancies of white blood cells.
3. **Lymphomas** – neoplasms of lymphoid tissue.
4. **Bleeding disorders** – due to platelet dysfunction or clotting factor deficiencies (e.g., hemophilia).
5. **Infections** – changes in WBC count (e.g., leukocytosis or leukopenia).
6. **Polycythemia** – increased RBC mass.

Tests Used in Blood Pathology:

➢ **Complete Blood Count (CBC)** – Evaluates RBCs, WBCs, platelets.

➢ **Peripheral Smear Examination** – Morphology of blood cells.

➢ **Coagulation Profile** – PT, aPTT, INR for bleeding disorders.

➢ **Bone Marrow Aspiration/Biopsy** – For diagnosing leukemia or marrow failure.

Pathology of Urine

Definition:

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

- The pathology of urine involves analysis of urine characteristics to detect diseases affecting the kidneys, urinary tract, and systemic metabolic disorders.

Common Urinary Abnormalities:

1. **Proteinuria** – seen in nephrotic syndrome, diabetes, hypertension.
2. **Hematuria** – blood in urine due to infection, stones, tumors.
3. **Glycosuria** – glucose in urine; common in uncontrolled diabetes.
4. **Pyuria** – pus cells in urine indicating UTI.
5. **Casts and Crystals** – indicative of renal disease or metabolic disorders.

Routine Urine Tests:

- **Urine Routine and Microscopy (R/M)**
- **Urine Culture and Sensitivity (C/S)**
- **24-hour Urine Collection** – for protein, creatinine clearance.
- **Dipstick Tests** – for glucose, ketones, protein, bilirubin, pH, specific gravity.

Lymphocytes – Their Role in Health and Disease

Definition

- Lymphocytes are a type of white blood cell (WBC) that play a vital role in the immune system, particularly in adaptive immunity, helping the body to recognize and remember specific pathogens.

Origin

- Derived from hematopoietic stem cells in the bone marrow.
- Mature in bone marrow (B cells) or thymus (T cells).

Types:

- **B-lymphocytes (B cells)**: Produce antibodies.
- **T-lymphocytes (T cells)**: Destroy infected or abnormal cells.
  - Helper T cells (CD4+): Activate immune response.
  - Cytotoxic T cells (CD8+): Kill infected cells.
- **Natural Killer (NK) cells**: Part of innate immunity; kill virus-infected or tumor cells.

Functions of Lymphocytes

A. B Cells

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

- Recognize antigens and produce antibodies (immunoglobulins).
- Differentiate into:
  - **Plasma cells**: actively secrete antibodies.
  - **Memory B cells**: retain antigen memory for rapid future response.

B. T Cells

- **Helper T cells ($CD4^+$)**: Activate B cells, cytotoxic T cells, and macrophages.
- **Cytotoxic T cells ($CD8^+$)**: Destroy virus-infected and tumor cells.
- **Regulatory T cells**: Suppress excessive immune responses to prevent autoimmunity.

C. Natural Killer (NK) Cells

- Recognize and kill cells lacking **MHC I** (e.g., virus-infected, tumor cells).
- Act **without prior sensitization**, unlike T and B cells.

Role in Health:

- **Immune defense** against viral, bacterial, and fungal infections.
- **Memory formation** for quicker immune response on re-exposure.
- **Tumor surveillance** and elimination of cancerous cells.

Role in Disease:

- **Lymphocytosis**: Elevated lymphocyte count.
  - **Causes**: Viral infections (e.g., mononucleosis), chronic lymphocytic leukemia (CLL).
- **Lymphocytopenia**: Reduced lymphocyte count.
  - **Causes**: HIV/AIDS, chemotherapy, bone marrow failure.

Platelets (Thrombocytes) – Their Role in Health and Disease

Definition

- Platelets are small, nucleated cell fragments derived from megakaryocytes in the bone marrow, playing a critical role in blood clotting (hemostasis).

Origin

- Formed from cytoplasmic fragments of megakaryocytes in the bone marrow.
- Lifespan: ~8–10 days.
- Removed by the **s**pleen and liver.

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

Structure

- Small (2–4 µm) disc-shaped cells.
- Contain:
  - Granules with clotting factors and enzymes.
  - Surface glycoproteins are essential for adhesion and aggregation.

Functions of Platelets and Their Descriptions

1. Primary Hemostasis

- Adhere to damaged vessel walls and form a temporary plug.

2. Secrete Clotting Factors

- Release substances (e.g., ADP, thromboxane A2) to recruit more platelets.

3. Activate Coagulation Cascade

- Aid in fibrin clot formation (secondary hemostasis).

4. Wound Healing

- Release growth factors (e.g., PDGF) to promote tissue repair.

5. Immunomodulation

- Interact with immune cells during inflammation.

Role in Health:

- **Primary Hemostasis**: Adhere to damaged endothelium and aggregate to form a platelet plug.
- **Secretion of granules**: Release factors like ADP, serotonin, and thromboxane A_2 to amplify clotting.
- **Support wound healing**.

Role in Disease:

A. Thrombocytopenia (Low platelet count):

- **Causes**: Dengue fever, ITP (Immune Thrombocytopenic Purpura), leukemia.
- **Effects**: Bleeding gums, petechiae, prolonged bleeding.

B. Thrombocytosis (High platelet count):

- **Causes**: Inflammation, iron deficiency, myeloproliferative disorders.
- **Effects**: Risk of thrombosis (stroke, myocardial infarction).

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

First Hope

FREE PREVIEW

Click here to visit our website

PHARMACY PREMIUM NOTES

Complete subject and semesters are available on FirstHope app only.

Scan or click here

Click here to get the app >

Available on Google Play

JOIN THE FIRSTHOPE COMMUNITY

Join our Telegram channel

Click here to join Telegram >

Scan or click here

@FirstHopeNotes

Instagram

@firsthope.official

Click here to follow >

YouTube channel

FirstHope-Pharmacy / Live streams

Click here to watch >

WhatsApp channel

Follow FirstHope on WhatsApp

Click here to join >

FirstHope website

firsthope.co.in

Click here to visit >

B.Pharm / D.Pharm / M.Pharm / Pharm.D

Preview notes. Complete subjects and semesters in the FirstHope app.