AL-mustaqbal university

College Of Health and Medical Techniques

Department of kidney dialysis techniques

Hematology

2nd stage

Lec.1

Introduction to Hematology

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Lecture 1: Introduction to Hematology

THE CONTENTS OF THE LECTURE

1. Definition of Hematology

Hematology is the branch of medical science that deals with the study of blood, blood-forming organs, and blood-related disorders. It covers the physiology, pathology, and clinical aspects of blood and its components, including red blood cells, white blood cells, platelets, plasma, and coagulation factors. This field is essential in both diagnostic and therapeutic medicine, as blood analysis provides valuable insights into the overall health status of an individual.

2. Importance of Hematology

- Diagnostic Value: Blood tests are crucial in diagnosing a wide range of diseases, from anemia and infections to cancers like leukemia.
- Monitoring Therapy: Hematology is important for monitoring the effects of treatments such as chemotherapy, anticoagulant therapy, or blood transfusions.
- Early Detection: Regular blood investigations help in the early detection of systemic diseases like diabetes, kidney failure, and cardiovascular conditions.
- Understanding Homeostasis: Blood plays a vital role in maintaining balance in the body, and studying its functions helps in understanding homeostatic mechanisms.
- Public Health: Haematological studies are key in controlling blood-borne diseases and ensuring safe blood transfusions.

Aspect	Explanation
Diagnostic Value	Helps in identifying anemia, infections, leukemia, etc.
Monitoring Therapy	Used to check effectiveness of chemotherapy, anticoagulants, transfusions.
Early Detection	Detects systemic diseases early (e.g., diabetes, kidney failure).
Homeostasis	Explains blood's role in pH, fluid, and temperature balance.
Public Health	Ensures safe blood transfusion and prevents blood-borne diseases.

3. General Functions of Blood

Blood is a specialized connective tissue that performs multiple essential functions:

1. Transport Function:

- Carries oxygen from lungs to tissues via hemoglobin in red blood cells.
- Transports carbon dioxide from tissues to lungs.
- Delivers nutrients (glucose, amino acids, fatty acids) from the digestive system to body cells.
- Transports hormones from endocrine glands to target organs.
- Removes metabolic wastes (urea, creatinine) to kidneys and liver for excretion.

2. Regulation Function:

- Maintains body temperature through distribution of heat.
- Balances pH using buffer systems (bicarbonate, phosphate, and proteins).
- Controls water and electrolyte balance across tissues.

3. Protection Function:

- White blood cells defend against pathogens.
- Platelets and clotting factors prevent blood loss through coagulation.
- Antibodies provide specific immune protection.

Function	Description	Examples
Transport	Movement of gases, nutrients, hormones, wastes.	O_2 via hemoglobin, CO_2 to lungs, glucose to cells.
Regulation	Maintains stability of body environment.	pH buffering, temperature control, electrolyte balance.
Protection	Defense and clotting.	WBCs against microbes, platelets for clotting, antibodies for immunity.

4. Blood Composition

Blood consists of two main components:

1. Plasma (55% of total blood volume):

- Composed mainly of water (90–92%).
- Contains plasma proteins: albumin, globulins, and fibrinogen.
- Dissolved substances: glucose, electrolytes (Na^+, K^+, Cl^-, Ca^{2+}), hormones, gases, and metabolic wastes.

2. Formed Elements (45% of total blood volume):

- Red Blood Cells (Erythrocytes): Transport oxygen and carbon dioxide.
- White Blood Cells (Leukocytes): Provide defense and immunity.
- Platelets (Thrombocytes): Involved in clotting and tissue repair.

Component	Percentage/Description	Key Elements
Plasma	~55% of blood; mostly water.	Proteins (albumin, globulins, fibrinogen), electrolytes, nutrients, hormones, wastes.
RBCs	~44% of blood (hematocrit).	Contain hemoglobin; transport O_2 and CO_2.
WBCs	<1% of blood.	Neutrophils, lymphocytes, monocytes, eosinophils, basophils.
Platelets	<1% of blood.	Involved in clotting and repair.

5. Physical and Chemical Constants of Blood

- Volume: ~5–6 liters in adult males, 4–5 liters in adult females.
- Color: Bright red (oxygenated) or dark red (deoxygenated).
- Viscosity: About 3–4.5 times thicker than water due to plasma proteins and cells.
- pH: Maintained between 7.35–7.45 (slightly alkaline).
- Specific Gravity: Plasma: 1.022–1.026; Whole blood: 1.050–1.060.
- Osmotic Pressure: ~300 mOsm/L, mainly regulated by sodium and plasma proteins.
- Temperature: Slightly higher than body temperature (~38°C).

Property	Normal Range / Value
Blood Volume	5–6 L in males; 4–5 L in females
pH	7.35–7.45 (slightly alkaline)
Viscosity	3–4.5 times that of water
Specific Gravity	Plasma: 1.022–1.026; Whole blood: 1.050–1.060
Osmotic Pressure	~300 mOsm/L
Temperature	~38°C (slightly above body temperature)
Color	Bright red (oxygenated), dark red (deoxygenated)

6. Summary

Hematology is the scientific study of blood and its components, vital for understanding human health and disease. Blood performs critical transport, regulatory, and protective functions, while its physical and chemical properties are tightly regulated to sustain life. A strong foundation in Hematology allows clinicians and researchers to diagnose, monitor, and treat a wide range of medical conditions effectively.