Department of Biochemistry

Laboratory Analysis of Blood Samples

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LEARNING OBJECTIVES

- Understand the Types of Blood Samples
- Learn Blood Collection Techniques.
- Evaluate Blood Components.
- Assess Laboratory Testing Purposes.
- Ensure Safe Practices.

Clinical biochemistry definition

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Clinical Biochemistry is a branch of laboratory medicine and pathology that involves the measurement of chemical substances in body fluids to support the diagnosis, treatment, and monitoring of disease.

Types of Samples in Clinical Chemistry Lab

1. Whole Blood.
2. Serum
3. plasma
4. Urine.
5. cerebrospinal fluid (CSF).
6. Synovial fluid
7. Amniotic fluid
8. Others like saliva, pleural, and seminal

Main Purposes of Laboratory Tests

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1. Diagnosis of Disease
2. Monitoring Disease Progression
3. Evaluating Treatment Effectiveness
4. Screening and Prevention
5. Guiding Clinical Decisions
6. Research and Public Health

Phlebotomy

Phlebotomy is a medical procedure that involves drawing blood from a patient, typically for laboratory testing, transfusion, or donation..

Blood can be obtained from:

1. Capillary
2. Veins
3. Arteries

Capillary sample

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A capillary sample is collected by a process called **skin puncture.**

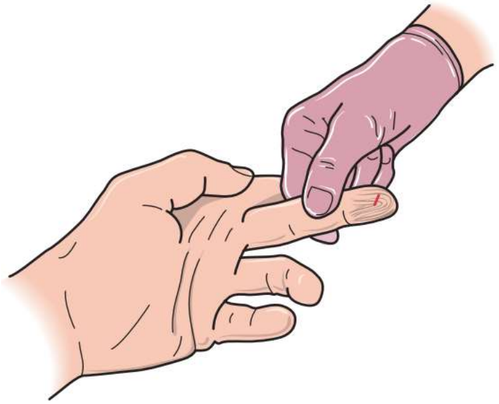
Skin puncture is an invasive blood collection technique in which blood is obtained by puncturing the skin, usually from the fingertip, heel, or earlobe.

- **When to Take a Capillary Sample?**

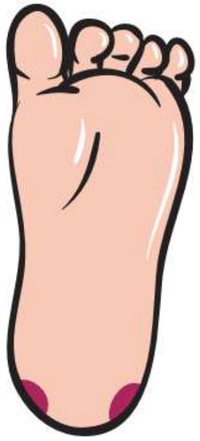
1. **Infants and young children.**
   - Their veins are too small or fragile for venipuncture.
   - Heel puncture is commonly used in newborns.
2. **Elderly or severely ill patients**
   - When veins are difficult to access or very fragile
3. **Need for a small volume of blood**
4. **Point-of-care testing (POCT)**
5. **Patients with severe burns or obesity**
   - Where venipuncture is difficult or painful.

Capillary sample

- Capillary collection is usually the preferred method of collection for newborns, infants, and children younger than 2 years



- For children younger than 1 year, there is too little tissue available in any of the fingers. For this reason, dermal puncture is performed in the heel; this process is called heel prick

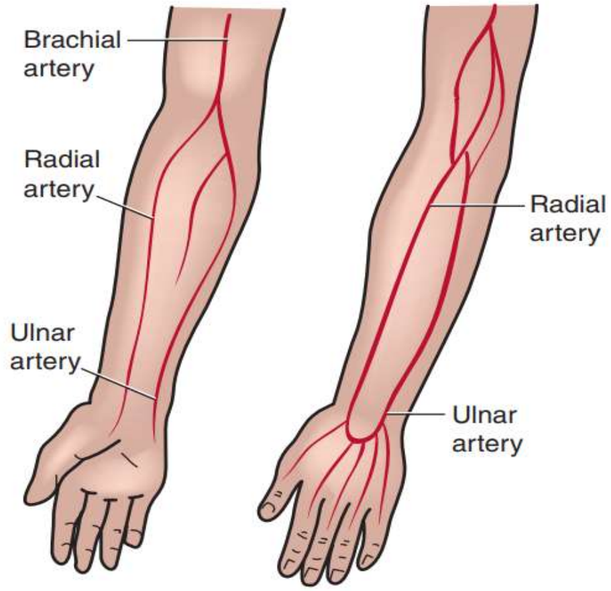


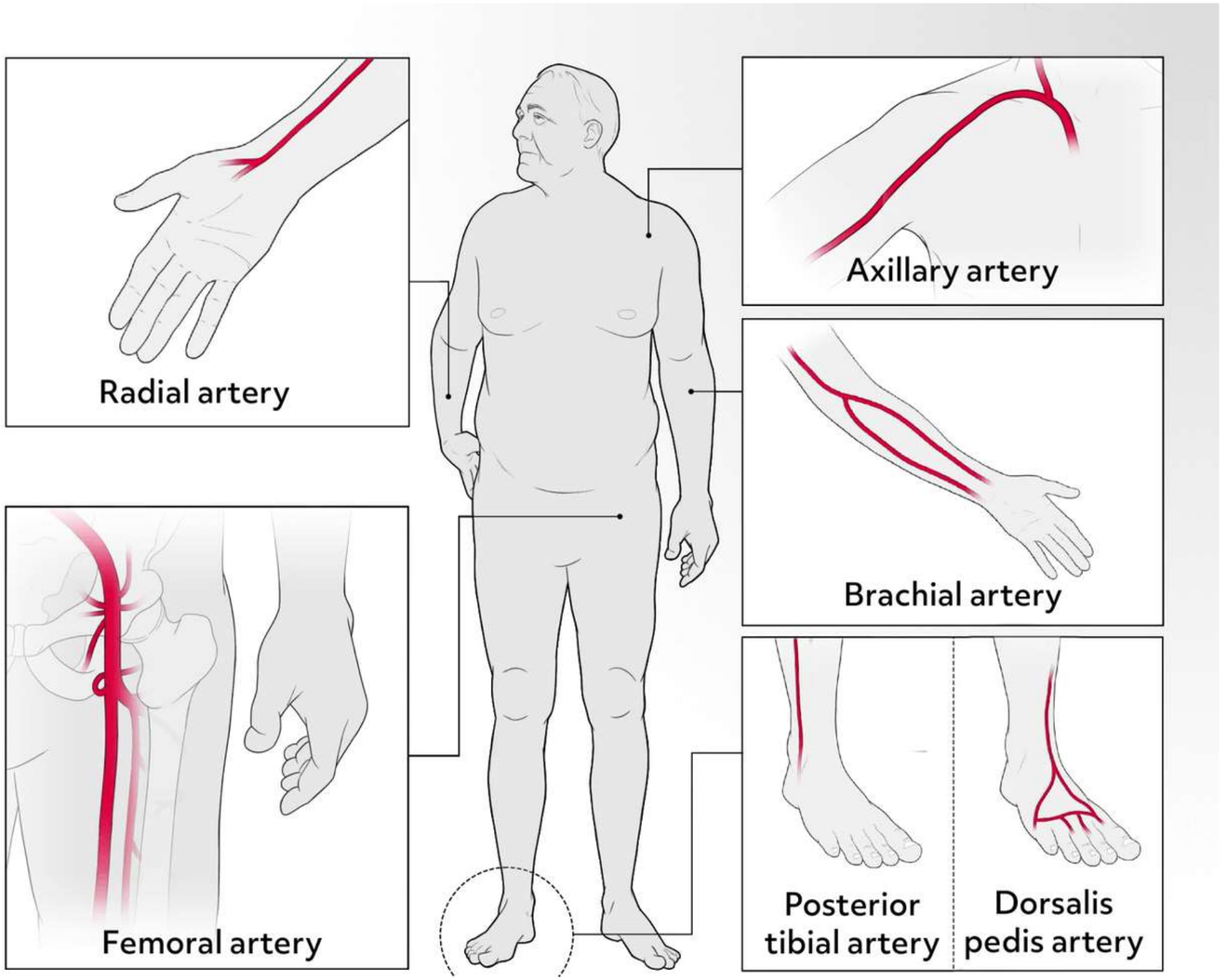
Arterial blood sample

Arterial blood sampling is a medical procedure in which blood is drawn directly from an artery rather than a vein..

Common Sites for arterial blood sample:

1. **Radial artery** (wrist) – most common site
2. **Brachial artery** (arm)
3. **Femoral artery** (groin) – used in emergencies





Arterial blood sample

Why take an arterial blood sample?

1. Assess **oxygenation (PaO_2)** and **carbon dioxide levels ($PaCO_2$)** in the blood.
2. Determine **blood pH** and acid-base status.
3. Monitor critically ill patients in intensive care units (ICU).

Precautions during collection of an arterial blood sample.

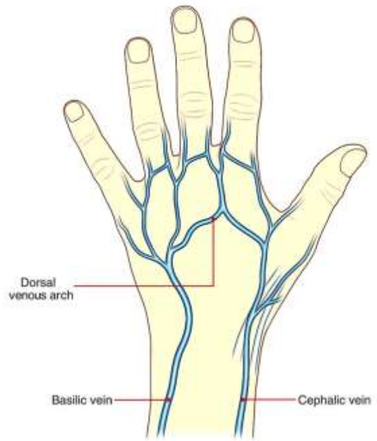
1. More painful and risky than venipuncture or capillary sampling.
2. Requires proper technique to avoid arterial spasm, bleeding, or hematoma.
3. Usually performed by trained healthcare professionals.

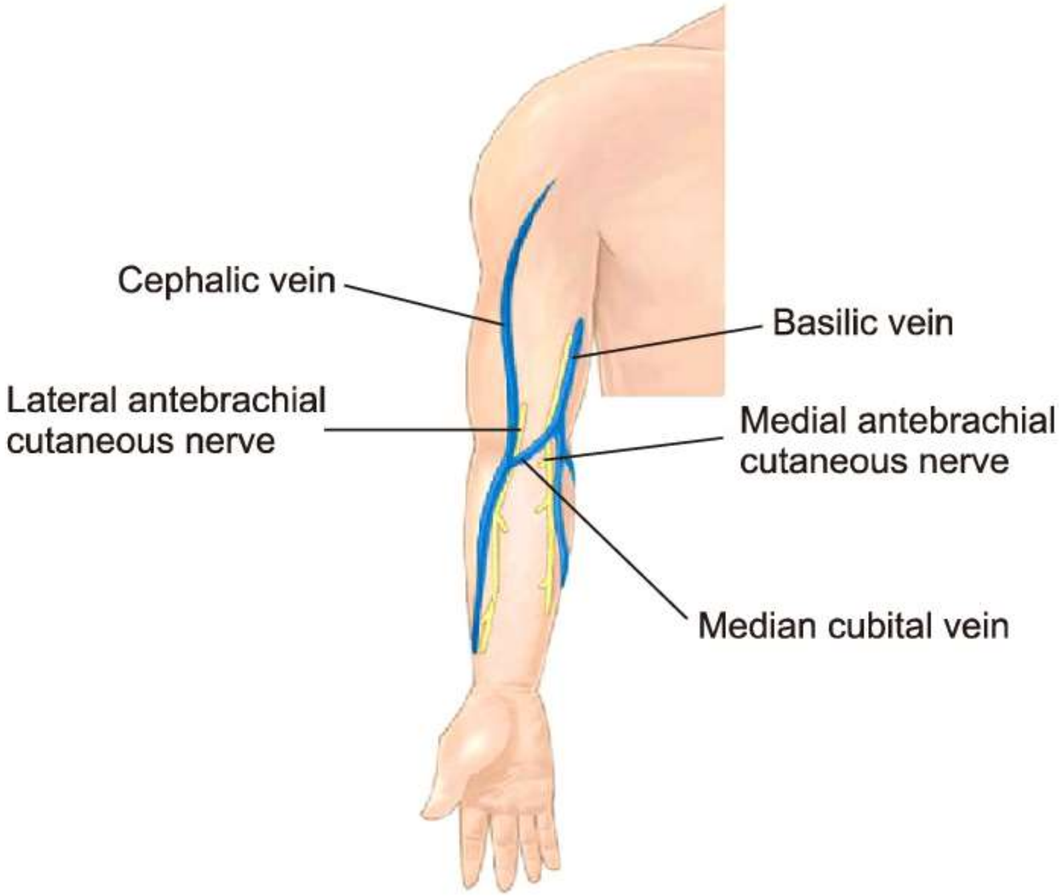
Venous blood sample

Venous blood sampling is a procedure in which blood is drawn from a vein, usually for laboratory testing, transfusion, or research purposes. It is the most common method of blood collection.

Common Sites to obtain an arterial blood sample

1. **Median cubital vein** – most preferred (inside of the elbow)
2. **Cephalic vein** – outer side of the arm
3. **Basilic vein** – inner side of the arm
4. **Dorsal hand veins** – if antecubital veins are not accessible





Venous blood sample

Indications of the vein sample

- Routine laboratory tests (e.g., complete blood count, chemistry panels, coagulation tests)
- Blood donation and transfusion
- Therapeutic purposes (e.g., phlebotomy in hemochromatosis)

Advantages of the venous blood sample

- Provides large volumes of blood
- Lower risk of contamination compared to capillary sampling
- Suitable for most laboratory tests

Comparison between the vein and artery

Arteries	Veins
Deeper, located near nerves	close to the skin
High pressure	Low pressure
Thick, elastic wall	Thin wall than an artery
More painful	Less painful
Higher risk (severe bleeding, arterial spasm, nerve injury)	Lower risk (limited bleeding, easier to manage
Special tests such as Arterial Blood Gas (ABG)	Routine laboratory tests, blood donation

Tools and material of phlebotomy

Gloves

Tourniquet

Cotton

Syringes & needles

Marker pen

Test-tubes

Instruction for proper blood collection

1. Identify the patient correctly (name, ID, date of birth)
2. Wash hands and wear gloves.
3. The patient should be seated or lying comfortably.
4. Arm to be extended straight from wrist to shoulder.
5. The tourniquet should be applied 3 to 4 inches above the puncture site.
6. Clean the site with 70% alcohol in a circular motion → allow to air dry.
7. Examine the working of a syringe.

Component of whole blood

❖ **Plasma** (≈ 55%)

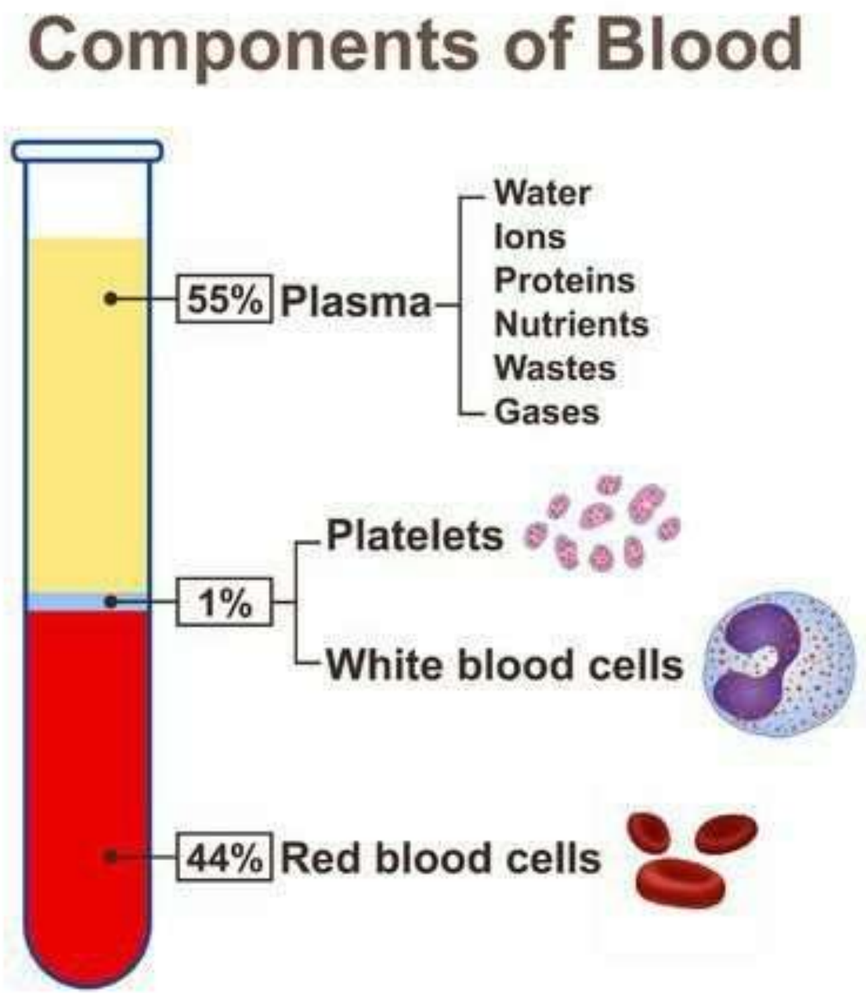
The liquid portion of blood represents ~90% water

Contains:

Proteins ,Electrolytes , Nutrients , Hormones
Metabolic waste products , Dissolved gases ,and
Clotting factors

❖ **The cellular components of blood**:

1. Red blood cells (Erythrocytes)
2. White blood cells (Leukocytes)
3. Platelets (Thrombocytes)



Serum & Plasma

Serum: the liquid portion of blood obtained after the blood has clotted, it is a clear, yellowish liquid on top of the tube

How Serum is Obtained:

1. Blood is collected in a tube without an **anticoagulant**.
2. The blood is allowed to clot naturally (usually 30–60 minutes at room temperature).
3. The sample is centrifuged, separating the clot from the liquid. (4500 rpm for 15 min)
4. The clear yellowish liquid on top is the serum.

Serum = Plasma – Clotting factors (fibrinogen)

Serum & Plasma

Clotting can be prevented by placing the blood into tubes containing an anticoagulant. Centrifuging then separates the red cells from the supernatant, and the result is **plasma**.

Plasma differs from serum in containing fibrinogen and coagulant factors

Serum = Plasma – Clotting factors (fibrinogen)

Serum & Plasma

Summary

- Clinical biochemistry definition.
- Types of Samples in Clinical Chemistry Lab
- Main Purposes of Laboratory Tests
- Blood obtained from: Capillary , Veins , Arteries ,(Comparison between the vein and artery)
- Component of whole blood.
- Instruction of **blood collection.**
- Understanding the difference between Serum & Plasma

Thank you for listening

Department of Biochemistry