Common Tests and Their Interpretation

- Clinical laboratory tests are essential tools used in diagnosing, monitoring, and evaluating disease states. These tests help healthcare providers understand the underlying pathology, assess the severity of a disease, and guide treatment decisions.
- The tests are usually performed on blood, urine, or other body fluids and tissues.

Haematological Tests

- Haematological tests are diagnostic procedures that evaluate the components and function of the blood. They are essential in diagnosing anemia, infections, bleeding disorders, hematological malignancies, and monitoring overall health.

Complete Blood Count (CBC)

Definition: A broad screening test used to evaluate overall health and detect a wide range of disorders.

Component	Normal Range	Significance
Hemoglobin (Hb)	Male: 13.5–17.5 g/dL Female: 12.0–15.5 g/dL	↓ in anemia, ↑ in polycythemia
Hematocrit (Hct)	Male: 41–53% Female: 36–46%	Measures RBC volume ratio
Red Blood Cells (RBC)	Male: 4.7–6.1 million/µL Female: 4.2–5.4 million/µL	↓ in anemia, ↑ in dehydration
White Blood Cells (WBC)	4,000–11,000 /µL	↑ in infections/inflammation, ↓ in bone marrow suppression
Platelets (PLT)	150,000–450,000 /µL	↓ in bleeding disorders, ↑ in thrombocytosis
Mean Corpuscular Volume (MCV)	80–100 fL	Microcytic (<80): Iron deficiency Macrocytic (>100): B12/folate deficiency
Mean Corpuscular Hemoglobin (MCH)	27–33 pg	↓ in hypochromic anemia
Mean Corpuscular Hemoglobin Concentration (MCHC)	32–36 g/dL	Measures Hb concentration in RBCs

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Erythrocyte Sedimentation Rate (ESR)

Definition: Measures the rate at which erythrocytes settle at the bottom of a test tube in an hour.

- **Normal Range**:
  - Men: <15 mm/hr
  - Women: <20 mm/hr
    Significance:
- ↑ in chronic infections, autoimmune diseases (RA, SLE), and malignancies.

Peripheral Blood Smear

Definition: Microscopic examination of stained blood film.

Significance:

- Identifies abnormal cell shapes (e.g., sickle cells, schistocytes, blast cells).
- Detects parasitic infections (e.g., malaria).

Reticulocyte Count

Definition: Measures immature RBCs in blood.

- **Normal Range**: 0.5–2.5% of RBCs

Significance:

- ↑ in hemolysis or blood loss (bone marrow response).
- ↓ in bone marrow failure or aplastic anemia.

Iron Studies

Test	Normal Range	Significance
Serum Iron	60–170 µg/dL	↓ in iron deficiency
TIBC (Total Iron Binding Capacity)	240–450 µg/dL	↑ in iron deficiency
Ferritin	Male: 24–336 ng/mL Female: 11–307 ng/mL	↓ in iron deficiency, ↑ in inflammation

Vitamin B12 and Folate Levels

- **B12 Normal Range**: 200–900 pg/mL
- **Folate Normal Range**: 2.7–17 ng/mL
  Deficiency leads to:
- Macrocytic anemia

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- Neurological Symptoms (B12)

Liver Function Tests (LFTs)

- Liver Function Tests (LFTs) are a group of blood tests used to assess the **h**ealth and function of the liver. They help evaluate:
    - Liver cell damage (hepatocellular injury)
    - Biliary obstruction (cholestasis)
    - Liver synthetic function (production of proteins like albumin and clotting factors)
- Each test in the LFT panel measures different enzymes, proteins, or substances that reflect how well the liver is functioning or whether it is damaged.

ALT (Alanine Aminotransferase / SGPT)

- **Normal Range:** < 40 IU/L
- **Function:** ALT is an enzyme found mainly in the liver. It plays a role in amino acid metabolism.
- **Clinical Significance:**
    - Elevated ALT suggests hepatocellular injury (damage to liver cells).
    - Common causes: viral hepatitis, non-alcoholic fatty liver disease (NAFLD), alcoholic hepatitis, drug-induced liver injury.

AST (Aspartate Aminotransferase / SGOT)

- **Normal Range:** < 40 IU/L
- **Function:** AST is found in the liver, heart, muscles, kidneys, and brain.
- **Clinical Significance:**
    - Elevated AST may indicate liver damage, but also muscle injury or cardiac conditions (like myocardial infarction).
    - A higher ALT/AST ratio usually suggests liver-specific damage.

ALP (Alkaline Phosphatase)

- **Normal Range:** 40–130 IU/L
- **Function:** Enzyme found in liver bile ducts, bones, intestines, and placenta.
- **Clinical Significance:**
    - Increased in cholestasis (bile flow blockage) or bone disorders (e.g., Paget’s disease, bone metastasis).

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- In liver disease, elevated ALP suggests biliary obstruction, such as gallstones or tumors compressing bile ducts.

Total Bilirubin

- **Normal Range:** 0.2–1.2 mg/dL
- **Function:** Bilirubin is a breakdown product of hemoglobin, processed by the liver and excreted in bile.
- **Clinical Significance:**
  - Elevated total bilirubin may indicate:
    - Liver dysfunction (e.g. hepatitis, cirrhosis)
    - Hemolysis (excessive breakdown of red blood cells)
    - Obstructive jaundice (e.g., bile duct blockage)

Direct (Conjugated) Bilirubin

- **Normal Range:** 0–0.3 mg/dL
- **Function:** This is bilirubin that has been processed by the liver for excretion.
- **Clinical Significance:**
  - Increased levels indicate cholestasis or bile duct obstruction.
  - Seen in obstructive jaundice, intrahepatic cholestasis, or primary sclerosing cholangitis.

Albumin

- **Normal Range:** 3.5–5.0 g/dL
- **Function:** A major protein synthesized by the liver, maintaining oncotic pressure and transporting substances.
- **Clinical Significance:**
  - Decreased in chronic liver disease (cirrhosis), malnutrition, nephrotic syndrome, or chronic illness.
  - It reflects liver synthetic function, especially in long-standing liver disease.

Prothrombin Time (PT)

- **Normal Range:** 11–13.5 seconds
- **Function:** Measures how long blood takes to clot; depends on clotting factors produced in the liver.
- **Clinical Significance:**
  - Prolonged PT suggests reduced liver synthesis of clotting factors.

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- Seen in severe liver disease, vitamin K deficiency, or warfarin use.
- PT is a key marker of liver synthetic capacity, particularly in acute liver failure.

Renal Function Tests

- Renal Function Tests (RFTs) are a group of blood and urine tests used to evaluate the function of the kidneys. They help assess how well the kidneys are filtering blood, maintaining electrolyte balance, and excreting waste products.
- These tests are essential in diagnosing acute kidney injury (AKI), chronic kidney disease (CKD), and electrolyte imbalances.

Blood Urea Nitrogen (BUN)

- **Definition**: Urea is the end product of protein metabolism, excreted by the kidneys.
- **Normal Range**: 7–20 mg/dL
- **Clinical Significance**:
  - ↑ in renal impairment, dehydration, high protein intake, GI bleeding
  - ↓ in liver disease, low protein intake

Serum Creatinine

- **Definition**: Creatinine is a waste product from muscle metabolism, cleared by the kidneys.
- **Normal Range**:
  - Male: 0.7–1.3 mg/dL
  - Female: 0.6–1.1 mg/dL
- **Clinical Significance**:
  - ↑ in kidney dysfunction
  - A more specific indicator than BUN

Estimated Glomerular Filtration Rate (eGFR)

- **Definition**: Calculated using serum creatinine, age, sex, and race to assess kidney function.
- **Normal Value**: >90 mL/min/1.73 m^2
- **Interpretation** (Stages of Chronic Kidney Disease - CKD):
  - **Stage 1**: ≥90 (normal with damage)
  - **Stage 2**: 60–89 (mild ↓)
  - **Stage 3**: 30–59 (moderate ↓)

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