**Complete Blood Count (CBC)**

A blood test that evaluates blood components to detect infections, anemia, inflammatory diseases, or hematological disorders.

**Components and Their Significance:**

- **Hemoglobin (HGB):**
  - A protein in red blood cells (RBC) that transports oxygen.
  - High levels may indicate polycythemia (excess RBCs).
  - Low levels may suggest anemia (iron deficiency or blood loss).
- **Erythrocytes (RBC - Red Blood Cells):**
  - Responsible for oxygen transport.
  - Increased levels may be due to dehydration, chronic hypoxia, or lung disease.
  - Decreased levels may indicate anemia or chronic disease.
- **Leukocytes (WBC - White Blood Cells):**
  - Involved in immune response.
  - High count may indicate infection, inflammation, stress, or leukemia.
  - Low count may suggest immunosuppression, chemotherapy, or autoimmune disorders.
- **Lymphocytes:**
  - A type of white blood cell involved in immune defense (against viruses and cancer cells).
  - Elevated levels may indicate viral infections.
  - Low levels may suggest immune deficiency or chronic stress.
- **Segmented and Band Neutrophils:**
  - First responders to bacterial infections.

    - High levels indicate acute infections, inflammation, or stress.
    - Low levels may be due to autoimmune diseases or severe infections.
- **Erythrocyte Sedimentation Rate (ESR):**
    - An indirect measure of inflammation.
    - High ESR may indicate infection, chronic inflammation (e.g., rheumatoid arthritis), or cancer.
    - Low ESR may be due to polycythemia.

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**2. Electrolyte Metabolism**

Electrolytes are essential for nerve conduction, muscle contraction, and fluid balance.

- **Calcium (Ca):**
    - Essential for bones, muscle contraction, and nerve transmission.
    - High levels may be due to hyperparathyroidism, cancer, or vitamin D toxicity.
    - Low levels may cause muscle cramps, osteoporosis, or hypoparathyroidism.
- **Magnesium (Mg):**
    - Important for muscle and nerve function.
    - High levels may cause muscle weakness and low blood pressure.
    - Low levels may lead to cardiac arrhythmias and cramps.
- **Potassium (K):**
    - Essential for heart function and muscle contraction.

    - High levels (hyperkalemia) can lead to cardiac issues.
    - Low levels (hypokalemia) can cause muscle fatigue and arrhythmias.
- **Sodium (Na):**
    - Regulates fluid balance and blood pressure.
    - High levels (hypernatremia) can be caused by dehydration.
    - Low levels (hyponatremia) may result from kidney disease or overhydration.

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**3. Coagulation System**

- **Fibrillation Start and End Times:**
    - Measure blood clotting ability.
    - Prolonged clotting time may indicate clotting disorders (e.g., hemophilia).
    - Shortened time may indicate a risk of thrombosis.
- **Platelets (Thrombocytes):**
    - Essential for blood clotting.
    - High levels can cause excessive clotting (thrombosis).
    - Low levels may lead to spontaneous bleeding.

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**4. Enzymatic System**

Enzymes are proteins that speed up chemical reactions in the body.

- **AST and ALT (Liver Enzymes):**
    - Assess liver function.
    - High levels may indicate hepatitis, alcoholism, or cirrhosis.

- **Amylase:**
    - Indicates pancreatic function.
    - High levels may suggest pancreatitis.

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**5. Oxygen Transport and Consumption**

- **Cardiac Output, Lung Capacity, Brain Oxygenation:**
    - Measure how efficiently oxygen is transported.
    - Abnormal values may indicate heart failure or lung disease.

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**6. CO2 Transport and Assimilation**

- **CO2 Emissions, CO2 Production Rate:**
    - Indicate the efficiency of cellular respiration.
    - Abnormal levels may be linked to respiratory diseases such as COPD.

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**7. Cardiomechanics and Circulatory System**

- **PQ, QT, QRS Intervals:**
    - Measure electrical conduction of the heart.
    - Prolonged intervals may indicate arrhythmias.
- **Systolic and Diastolic Blood Pressure:**
    - Essential for diagnosing hypertension or hypotension.

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**8. Energy Metabolism and Muscular Function**

- **Muscle and Cardiac Creatine Kinase:**

    - Indicates muscle or cardiac damage (e.g., heart attack, myopathy).
- **Glycogen Levels:**
    - Represents energy storage.
    - Deficiency may be linked to metabolic disorders.

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**9. Fluid Balance and Distribution**

- **Extracellular and Intracellular Water:**
    - Assesses body hydration.
- **Blood Flow to Organs:**
    - Abnormalities may indicate circulatory disorders.

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**10. Hormonal Function and Metabolism**

- **Urinary Testosterone and Estrogen:**
    - Regulate sexual function and growth.
    - Imbalance may cause hormonal disorders.
- **Acetylcholine and Acetylcholinesterase:**
    - Involved in nerve transmission.
    - Deficiency can affect memory and muscle function.

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**11. Internal Blood Flow Distribution**

- **Blood Circulation to Specific Organs:**
    - Evaluates blood supply to the heart, muscles, liver, brain, kidneys.
    - Reduced flow may indicate cardiovascular diseases.