Serum Phosphorus

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- Serum phosphorus refers to the concentration of phosphate (PO_4-3) in the blood. It is a critical electrolyte involved in many physiological processes, including energy metabolism, bone formation, and cellular function
- Phosphorus in the body mainly exists as phosphate, and about 85% of it is stored in bones and teeth

Physiological Functions of Phosphorus

- **a. Energy Metabolism**
- • Essential component of ATP (adenosine triphosphate)
- • Involved in cellular energy transfer
- **b. Bone and Teeth Formation**
- • Combines with calcium to form hydroxyapatite crystals

- **c. Cellular Structure**
- • Component of:
- • Cell membranes (phospholipids)
- • DNA and RNA
- **d. Acid-Base Balance**
- • Acts as a buffer system in blood

Regulation of Serum Phosphorus

- **Phosphate balance is tightly regulated by:**
- **a. Kidneys**
- • Primary regulator (excretion/reabsorption)
- b. Hormones
- • Parathyroid Hormone (PTH)
- ↓ decreases phosphate reabsorption → increases excretion
- • Vitamin D (Calcitriol)
- ↑ increases intestinal absorption of phosphate
- • Fibroblast Growth Factor 23 (FGF23)
- ↓ reduces phosphate reabsorption in kidneys

Hyperphosphatemia (High Serum Phosphorus)

- **Definition:**
- Serum phosphorus > 4.5 mg/dL
- **Causes:**
- Chronic kidney disease (CKD) (most common)
- Hypoparathyroidism
- Excess vitamin D
- Tumor lysis syndrome
- Rhabdomyolysis

- **Clinical Features:**
- Often asymptomatic
- May cause:
- Hypocalcemia
- Tetany
- Soft tissue calcification

Hypophosphatemia (Low Serum Phosphorus)

- **Definition:**
- Serum phosphorus < 2.5 mg/dL
- **Causes:**
- Malnutrition
- Alcoholism
- Refeeding syndrome
- Hyperparathyroidism
- Vitamin D deficiency

- **Clinical Features:**
- Muscle weakness
- Respiratory failure (severe cases)
- Bone pain (osteomalacia)
- Neurological symptoms

Laboratory Measurement

- **Sample:**
- • Blood (serum)
- **Methods:**
- • Colorimetric assays (molybdate method)
- **Factors Affecting Results:**
- • Hemolysis (false elevation)
- • Diurnal variation (higher in morning)
- • Diet

Clinical Significance

- **Used in evaluation of:**
- Kidney function
- Bone disorders
- Parathyroid disorders
- Important in ICU and critical care settings
- Helps monitor dialysis patients

Relationship with Calcium

- **Inverse relationship:**
- ↑ Phosphate → ↓ Calcium
- Controlled by PTH and Vitamin D

Normal Range

- Adults: 2.5 – 4.5 mg/dL (0.81 – 1.45 mmol/L)
- Children: Higher due to bone growth

- Phosphorus is essential for energy, structure, and metabolism
- Regulated mainly by kidneys and hormones
- Imbalances can lead to serious systemic effects
- Important diagnostic marker in many diseases


Thank You