Review (FITB)

Electrolytes are divided into _____ (positively charged) and _____ (negatively charged) ions. Sodium (Na^+) is primarily found in the _____ fluid, while potassium (K^+) is primarily found in the _____ fluid. Calcium (Ca^{2+}) plays a key role in _____, _____, and _____. Magnesium (Mg^{2+}) is important for _____ stability and enzyme activation. Phosphate (PO_4^{3-}) is essential for _____ production and bone health. The major anion in extracellular fluid is _____ (Cl^-), while bicarbonate (HCO_3^-) is a key component of the _____ system to regulate pH. Potassium levels are primarily regulated by the _____ (organ).

The _____ hormone increases sodium reabsorption and potassium excretion in the kidneys. _____ promotes water retention, reducing urine output. _____ and _____ are cardiac hormones that reduce blood volume during fluid overload. The renin-angiotensin-aldosterone system (RAAS) is activated in response to _____. Excessive ADH production leads to _____, causing dilutional hyponatremia.

Normal serum sodium range is _____ - _____ mEq/L. Symptoms of hyponatremia include _____, _____, and _____. Severe hyponatremia can result in _____ and _____ if untreated. Hypernatremia can result from _____ or insufficient water intake, leading to _____ and _____. Treatment for hypernatremia typically includes _____ to correct water deficit.

Normal serum potassium range is _____ - _____ mEq/L. Common causes of hypokalemia are _____, _____, and _____. Hypokalemia can cause _____ and _____ in ECG readings. Hyperkalemia may result from renal failure or uncontrolled diabetes, with symptoms such as _____ and _____. Hyperkalemia is often treated with _____ and _____ to reduce serum potassium levels.

Hypocalcemia can present with _____ and _____. Positive _____ and _____ signs indicate low calcium levels. Hypercalcemia is often caused by _____ or malignancy and presents with _____ and _____. Chronic renal failure can result in persistent _____ due to impaired phosphate excretion. Magnesium plays a role in enzyme activation and cardiac stability, with normal levels between _____ and _____ mEq/L. Magnesium sulfate is used to treat _____, especially in obstetric emergencies like preeclampsia. Magnesium levels below _____ mEq/L can lead to tremors, seizures, and cardiac dysrhythmias, while excessive magnesium intake can cause _____ and decreased deep tendon reflexes.

Fluid volume deficit (FVD) can be caused by _____, _____, or _____. Symptoms of FVD include _____, _____, and tenting of the skin. Key clinical indicators for monitoring FVD are _____. Treatment for FVD typically involves _____ fluids, such as 0.9% sodium chloride or lactated Ringer's. Patients with heart failure are at high risk for developing _____. A key clinical indicator for monitoring FVE is _____. Treatment for FVE may involve _____ therapy and fluid restriction.

Electrolyte imbalances can lead to significant complications if untreated. Hyperkalemia can result in _____, _____, and _____. Hypokalemia often causes _____ and muscle cramps, while severe hypokalemia can lead to _____. Calcium is crucial for _____ health and blood clotting, with normal levels ranging from _____ to _____ mg/dL. Hypocalcemia presents with signs like _____ and _____, while hypercalcemia can cause _____, lethargy, and muscle weakness. Patients with chronic kidney disease are at increased risk for _____ imbalances due to impaired excretion.

Magnesium is vital for _____ and enzyme activation. A deficiency can result in _____, _____, and prolonged QT intervals on ECG. Excess magnesium can cause _____, leading to decreased respiratory drive and hypotension. It is often found in patients who take excessive _____-based antacids or laxatives.

The body uses various mechanisms to regulate pH and fluid balance. The kidneys primarily regulate _____ balance, while the lungs control _____ levels. When metabolic acidosis occurs, the lungs compensate by _____, which helps reduce carbon dioxide and acidity. In metabolic alkalosis, respiratory compensation results in _____ to retain carbon dioxide and correct pH.

Fluid volume regulation is crucial in maintaining hemodynamic stability. Patients with fluid volume deficit may experience _____, _____, and dizziness upon standing. Fluid volume excess is often associated with _____, jugular vein distention, and pulmonary crackles. Patients with heart failure are particularly prone to _____, necessitating strict fluid and sodium restrictions.

The renin-angiotensin-aldosterone system (RAAS) helps regulate blood pressure and fluid balance. When blood pressure drops, the kidneys release _____, which converts angiotensinogen to angiotensin I. Angiotensin I is then converted to angiotensin II by _____, causing vasoconstriction and stimulating the release of _____ from the adrenal glands.

SIADH results in water retention and dilutional _____, while diabetes insipidus leads to excessive _____ and dehydration. Management of SIADH involves _____ restriction, while treatment for diabetes insipidus often includes administering _____. Laboratory findings in SIADH may show a _____ serum sodium and concentrated urine.

Answer Key

Electrolyte Basics:
• Cations, Anions
• Extracellular, Intracellular
• Muscle contraction, Nerve transmission, Blood clotting
• Cardiac stability, ATP production
• Chloride, Buffer system, Kidneys

Hormonal Regulation:
• Aldosterone, Antidiuretic hormone (ADH), Atrial Natriuretic Peptide (ANP), Brain Natriuretic Peptide (BNP)
• Low blood pressure or decreased renal perfusion
• Syndrome of Inappropriate Antidiuretic Hormone (SIADH)

Sodium Imbalances:
• 135-145 mEq/L
• Confusion, Restlessness, Seizures
• Seizures, Coma
• Dehydration, Increased thirst, Dry mucous membranes
• Hypotonic fluids (e.g., 0.45% sodium chloride)

Potassium Imbalances:
• 3.5-5.0 mEq/L
• Diuretics, GI losses (vomiting, diarrhea), Inadequate intake
• Flattened T waves, Presence of U waves
• Cardiac dysrhythmias, Muscle weakness
• Calcium gluconate, Insulin with glucose

Calcium and Magnesium Imbalances:
• Bone, 8.5-10.5 mg/dL
• Trousseau's sign, Chvostek's sign
• Hyperparathyroidism, Fatigue, Confusion
• Hyperphosphatemia, Seizures and severe preeclampsia
• 1.5 mEq/L, Lethargy

Fluid Volume Regulation:
• Vomiting, Diarrhea, Hemorrhage
• Hypotension, Tachycardia, Tenting skin turgor
• Daily weight, IV fluids (0.9% sodium chloride or lactated Ringer's)
• Fluid volume excess (FVE), Pulmonary crackles, Heart failure

pH and Acid-Base Regulation:
• Bicarbonate, Carbon dioxide
• Hyperventilation, Hypoventilation

SIADH and Diabetes Insipidus:
• Hyponatremia, Polyuria
• Fluid restriction, Vasopressin administration
• Low serum sodium, High urine osmolality