Fuid, Electrolytes, acid- Base Balance

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Distribution of Body Fluid

- Intracellular
- Extracellular
  - Intravascular
  - Intersitial
- Transcellular

Fluid Output

- Urine
- Insensible losses
  - Lungs
  - skin
- Sweat
- Feces

Homeostasis

- Kidneys
  - 135-180 liters of plasma/day
  - Acid base balance
- Hormone

Electrolytes

- sodium
- potassium
- calcium
- magnesium
- chloride
- phosphate
- bicarbonate

Sodium (Na+)

- Regulation-ECF
  - Aldosterone ↑ Na reabsorption
  - renal
- Function
  - Maintain blood volume
    - Transmission of nerve impulses and muscle contraction
- 135-145 mEq/L
- Sources
  - Bacon, ham, processed cheese, table salt

Sodium (Na+)

hyponatremia

- GI tract
- Diaphoresis
- Diuretics
- Too much H2O
  - Lethargy, confusion apprehension
  - Abdominal cramps
  - Muscle twitching
  - Anorexia, N/V
  - Headache
  - Seizures, coma
    - SIADH, head injury, AIDS, malignant tumors

hypernatremia

- Water loss
- Diarrhea
- IV saline solution
- Hypertonic tube feed without enough H2O
- Too much salt
  - Thirst, dry sticky mucous
  - Tongue red, dry, swollen, weakness
  - Fatigue, restlessness
  - ↓ LOC
  - Disorientation
  - convulsions

Potassium (K+)

- Regulation-ICF small amts in ECF
  - Renal
  - Aldosterone ↑ K+ excretion
  - Insulin helps K move into tissue
- Function
  - Nerve and electrical impulses
  - Cardiac impulse and muscle ctx
  - Acid-base balance
  - Skeletal and smooth muscle
- 3.5-5 mEq/L
- Sources
  - Banana, Avocado, raw carrots, orange/OJ, baked potato, raw tomato, spinach, dried fruits (raisins and dates), cantaloupe, beef, cod, pork, veal

Potassium (K+)

hypokalemia

- Vomiting/GI suction
- Diarrhea
- Heavy perspiration
- Diuretic
- Poor intake of K+
- hyperaldosteronism
  - muscle weakness, leg cramps
  - fatigue, lethargy
  - anorexia, N/V
  - dysrhythmia
  - depressed DTR
  - weak irregular pulse

hyperkalemia

- Renal failure
- hypoaldosteronism
- K sparing diuretics
  - GI hyperactivity-diarrhea
  - Irritability, apathy, confusion
  - Dysrhythmia or arrest
  - Muscle weakness, areflexia
  - ↓ heart rate
  - Irregular pulse

Calcium (Ca^{2+})

- Regulation
  - Parathyroid and calcitriol ↑ levels
  - Calcitonin ↓ levels
  - ↑ age → ↓ in GI absorption →osteoporosis
- Function
  - Stored in skeletal muscle
  - Bone, teeth
  - Nerve impulses
  - Muscle contraction
  - Cardiac pacemaker
  - Blood clotting
- 8.5-10.5 mg/dL
- Sources
  - Milk & milk products, dark green leafy vegetables, salmon

Calcium (Ca2+)

hypocalcemia

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- hypoparathyroidim
- Acute pancreatitis
- hyperphosphatemia
- Thyroid cancer
- Poor intake vit. D
- Malabsorption
- Hypomagnesemia
- Alkalosis, sepsis, alcohol abuse

- S/S
  - Numbness, tingling around mouth and extremities,
  - Muscle tremors, cramps, tetany and convulsions
  - Dysrhythmia, ↓ CO
  - + trousseau's and Chvostek's signs
  - Confusion, anxiety, psychosi
  - Hyperactive DTR

Calcium (Ca2+)

hypercalcemia

- Immobilization
- Hyperparathyroidism
- Bone cancer
- Paget's disease

- S/S
  - Lethargy, weakness,
  - Depressed DTR
  - Bone pain
  - Anoriexia, N/V
  - Constipation
  - Polyuira, hypercalciuria
  - Flank pain
  - Dysrhythmia, possible heart block

Magnesium (Mg^{2+})

- Regulation
  - Renal
  - Intestinal absorption ↑ by vitD and parathyroid hormone
- Function
  - Intracelluar metabolism
  - Relaxin muscle ctx
  - Nerve impulses
  - Cardiac function
- 1.5- 2.5 mEq/L
- Sources
  - Grain cereals, nuts, dried fruits, legumes, green leafy vegetables, dairy products, meat, fish

Magnesium (Mg^{2+})

hypomagnesemia

- Diarrhea, suction
- Diuretic, aminoglycoside antibiotic
- Chronic alcoholism
- Pancreatitis
- Burns

- S/S
  - + trousseau's and Chvostek's signs
  - Neuro irritability, tremors
  - ↑ reflexes
  - Convulsion
  - Tachycardia
  - ↑ bp
  - Dysrhythmis
  - Confusion
  - Vertigo
  - Anorexia
  - Dysphagia
  - Respiratory difficulties

Magnesium (Mg^{2+})

hypermagnesemia

- Renal failure
- Adrenal insufficiency
- Treatment with magnesium

- S/S
  - Peripheral vasodilation
  - Flushing
  - Muscle weakness
  - Paralysis
  - Hypotension
  - Bradycardia
  - Depressed DTR
  - Lethargy, drowsy
  - Resp. depression, coma
  - Resp/cardiac arrest if severe

Chloride (Cl-)

- Regulation
  - Conjuction with Na
  - Aldosterone ↑ Cl- resabsorption with Na
- Function
  - ECF and vascular volume
  - Acid-base balance
  - Buffer in O2 & CO2 in RBC's
- 95- 108 mEq/L
- Sources
  - Same as sodium foods

Chloride (Cl-)

hypochloremia

- GI tract
- Renal
- Sweat
  - Alkalosis
  - Twitching
  - Tremors
  - Tetany

hyperchloremia

- Excessive relacement of Na or K
  - Acidosis
  - Weakness
  - Lethary
  - dysrhythmia
  - Coma

Phosphate (PO_4^-)

- Regulation
  - ↑ Ca → ↓ PO_4^-
  - With Na in renal
  - Parathyroid ↓ levels by excretion
- Function
  - Bone & teeth
  - Metabolizes CHO, protein and fats
  - Cellular metabolism
  - Muscle, nerve, and RBC
  - Acid-base balance
  - Regulates Ca levels
- Sources
  - Meat, fish, poultry, milk products, legumes

Phosphate (PO4-)

hypophosphatemia

- Glucose and insulin administration
- TPN
- Alcohol withdrawal
- Acid-base imbalance
- Antacids
  - Parasthesias
  - Muscle weakness/pain
  - Mental changes
  - seizures

hyperphosphatemia

- Tissue trauma
- Chemotherapy
- Renal failure
- Excessive ingestion
- Infants fed cow milk
- Enemas/laxatives
  - Numbness/tingling around mouth and fingertips
  - Muscle spasms
  - tetany

Bicarbonate (HCO3-)

- Regulation
  - renal
- Function
  - Acid-base balance
- Sources
  - Produced through metabolic process