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**Causes of Hyperkalaemia**

* ***Decreased or impaired potassium excretion*** – renal failure, potassium-sparing diuretics, urinary obstruction, sickle cell disease, Addison disease, and systemic lupus erythematosus (SLE)
* ***Additions of potassium into extracellular space*** - potassium supplements (eg, PO/IV potassium, salt substitutes), rhabdomyolysis, and hemolysis (eg, blood transfusions, burns, tumor lysis)
* ***Transmembrane shifts*** (ie, shifting potassium from the intracellular to extracellular space) - acidosis and medication effects (eg, acute digitalis toxicity, beta-blockers, succinylcholine)
* ***Factitious or pseudohyperkalemia*** - improper blood collection (eg, ischemic blood draw from venipuncture technique), laboratory error, leukocytosis, and thrombocytosis

**ECG Changes**

* *From reduction of P wave amplitude and prolongation of PR interval to absence of P waves altogether.*
* *Increase of QRS duration.*
* *Increase of QT duration.*
* *Slowing of heart rate.*
* *T waves become tall and spiked.*
* *Decreased R wave amplitude*



**3 Principles of Treatment**

* Stabilise myocardium
* Move it into cells
* Increase elimination

**Dextrose – Insulin 1.**

 **2.Calcium Gluconate**

**Sodium Bicarbonate** 3.

**Calcium Resonium** 4.

* Salbutamol 5.
* 6.Furosemide

7.haemodialysis

***HYPOKALEMIA***

*Causes of Hypokalemia*

**I. Decreased intake**

 A. Starvation

 B. Clay Ingestion

**II. Redistribution into Cells**

 A. Acid-Base (Metabolic Alkalosis)

 B. Hormonal (Insulin, Beta agonist, Alpha )

 C. Anabolic State (folic acid)

 D. Other (Hypothermia, Pseudohypokalemia

**III. Increased Loss**

 A. **Nonrenal**

 1. **Gastrointestinal Los**

 2. Integumentary Loss (sweat)

 B. Renal

SIGNS & SYMPTOMS

Fatigue

Myalgia

Muscular weakness & paralysis

Hyporeflexia

Dyspnea

Arrhythmia

Predispose to digitalis toxicity

Constipation

**ECG changes**

Due to delayed ventricular repolarization

Early changes: flattening or inversion of T wave, prominent U wave, ST-segment depression, prolonged QU interval

Severe K+ depletion: prolonged PR interval, decreased voltage and widening of QRS complex

Calcium

**Body requirements**

* Age (in years) Calcium Requirement
* 1 – 3 500mg
* 4 - 8 800mg
* 9 - 18 1300mg
* 19 - 50 1000mg
* 51+ 1500mg

\*Pregnant and lactating women are recommended a daily calcium intake of 1000mg

Calcium in the plasma:

Only 1%

 45% in ionized form (the physiologically active form)

 45% bound to proteins (predominantly albumin)

 10% complexed with anions (citrate, sulfate, phosphate)

To estimate the physiologic levels of ionized calcium in states of hypoalbuminemia:

[Ca+2]Corrected = [Ca+2]Measured + [ 0.8 (4 – Albumin) ]

***Hypercalcemia***

**Increased GI Absorption:**

 Vitamin D excess

 Elevated PTH

**Decreased Urinary Excretion:**

 Thiazide diuretics

**Increased Loss From Bone:**

 Elevated PTH

 Hyperparathyroidism

 Malignancy

 Osteolytic metastases

**Complication:**

Metastatic calcification

Renal stones

***Treatment of hypercalcaemia:***

**Saline/fluid hydration :**

 --**increases renal calcium excretion**

 ---2 to 4 L IV daily for 1 to 3 days

**Biphosphonates :**

 **---inhibition bone resorption**

 **---**Pamidronate (Aredia), 60 to 90 mg IV over 4 hours

**Calcitonin :**

 ----**inhibition bone resorption and increases renal calcium excretion**

 **----**4 to 8 IU per kg IM or SQ every 6 hours for 24 hours

 **Plicamycin (Mitharmycin) :**

 ----**decreases bone resorption**

 **----**25 mcg per kg per day IV over 6 hours for 3 to 8 doses

**Gallium nitrate :**

 -----**inhibition bone resorption**

 **-----**100 to 200 mg per m2 IV over 24 hours for 5 days

**Glucocorticoids :**

 ----**Inhibits vitamin D conversionto calcitriol**

 -----Hydrocortisone, 200 mg IV daily for 3 days

**Hemodialysis :**

 **---used in patients with renal failure**

* **Hypocalcaemia**
* Is a condition in which the calcium level below
* The normal level
* Is caused by low level of PTH , low level of magnesium, deficiency of vitamin D
* The kidney dysfunction play role in hypocalcuimia

**Etiology of the hypocalcemia**

* Decreased GI Absorption
* Poor dietary intake of calcium,impair absorption
* Increased Urinary Excretion
* Decreased Bone Resorption/Increased Mineralization
* Low PTH
* PTH resistance

Vitamin D deficiency

**Tetany**

