มหาวิทยาลัยราชภัฏนครปฐม
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Nursing care of patients with Electrolyte Imbalance

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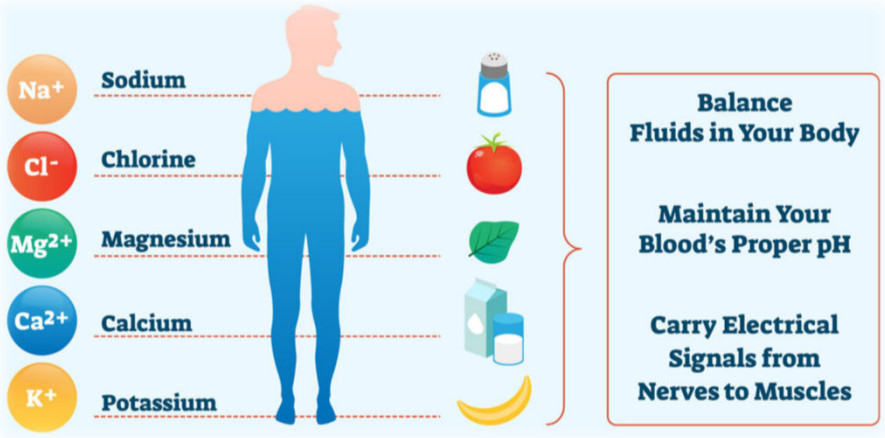
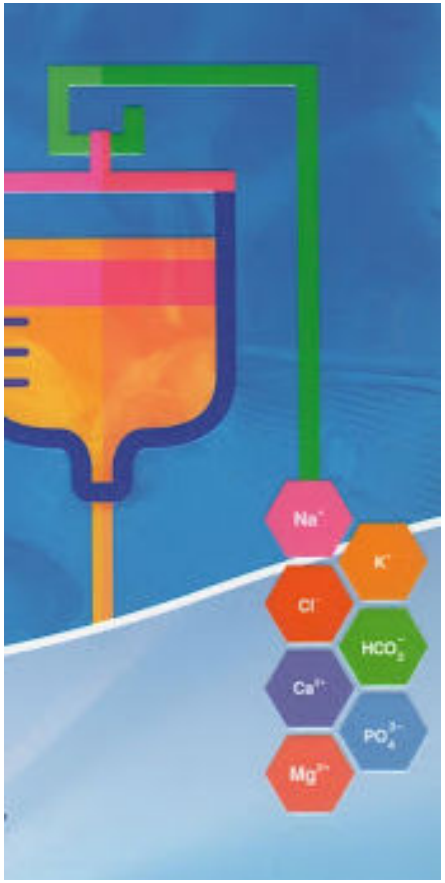
INTRODUCTION

- Electrolyte imbalance is an abnormality in the concentration of electrolytes in the body.
- Electrolytes play a vital role in maintaining
- homeostasis within the body.
- They help to regulate heart and neurological function, fluid balance, oxygen delivery, acid–base balance and much more.



The Main Electrolytes Concentrations in the human body



- Sodium (Na) 135-145 mEq/L
- Potassium (K) 3.5-5.0 mEq/L
- Chloride(Cl) 95-105 mEq/L
- Magnesium(Mg) 1.5-2.5 mEq/L
- Calcium (Ca) 8.6 – 10.2 mg/dl
- Phosphorus (PO_4^-) 2.5-4.5 mg/dl
- Bicarbonate (HCO_3^-) 22-30 mEq/L

Major electrolyte imbalances

- Hyponatremia (sodium deficit <130 mEq/L)
- Hypernatremia (sodium excess >145 mEq/L)
- Hypokalemia (potassium deficit <3.5 mEq/L)
- Hyperkalemia (potassium excess >5.1 mEq/L)
- Hypocalcemia (calcium deficit <8.5 mg/dL)
- Hypercalcemia (calcium excess >10.2 mg/dL)
- Chloride imbalance (<98 mEq/L or >107 mEq/L)
- Magnesium imbalance (<1.5 mEq/L or >2.5 mEq/L)

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Hyponatremia

Definition: Commonly defined as a serum Na concentration <135 mEq/L.

Hyponatremia represents a relative excess of water in relation to sodium.

It is the most common electrolyte disorder

Types

- Hypovolemic hyponatremia
- Euvolemic hyponatremia
- Hypervolemic hyponatremia
- Redistributive hyponatremia

Types

- **Hypovolemic hyponatremia**

➢ Develops as sodium and free water are lost and/or replaced by inappropriately hypotonic fluids

- **Euvolemic hyponatremia**

➢ Sodium deficit is more and the water volume remains same.

Types

- **Hypervolemic hyponatremia -** Total body sodium increases, and total body water increases to a greater extent.
- **Redistributive hyponatremia -** Water shifts from the intracellular to the extracellular compartment, with a resultant dilution of sodium. The total body water and total body sodium are unchanged.

- **Etiology**

➢Sodium can be lost through renal or non-renal routes

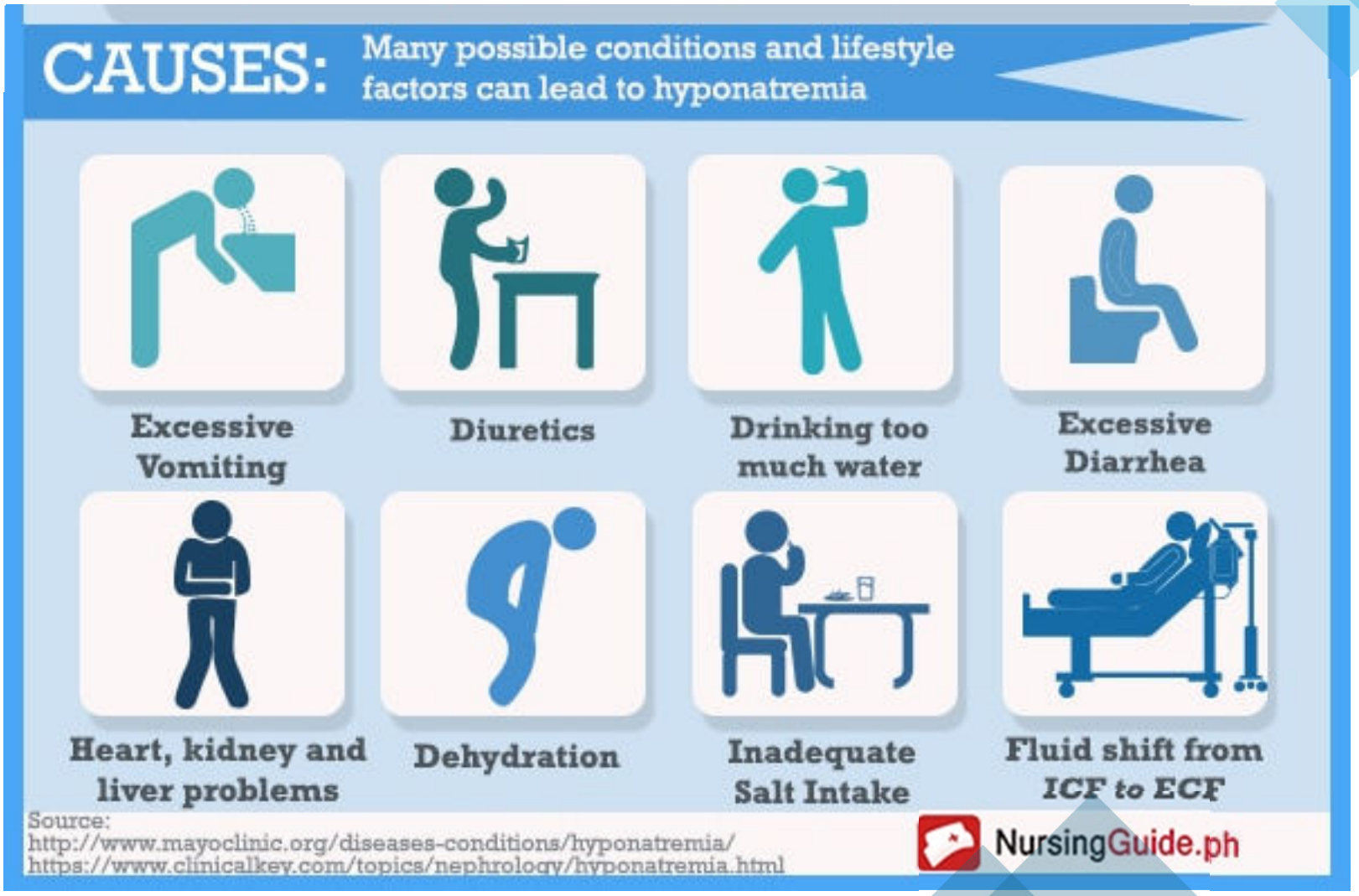
❖**GI losses-** Vomiting, Diarrhea, fistulas, pancreatitis

❖ **Excessive sweating**

❖ **Third spacing of fluids-** ascites, peritonitis, pancreatitis, and burns

❖**Cerebral salt-**wasting syndrome- traumatic brain injury, aneurysm subarachnoid hemorrhage, and intracranial surgery

❖**Renal Loss-** Acute or chronic renal insufficiency, Diuretics

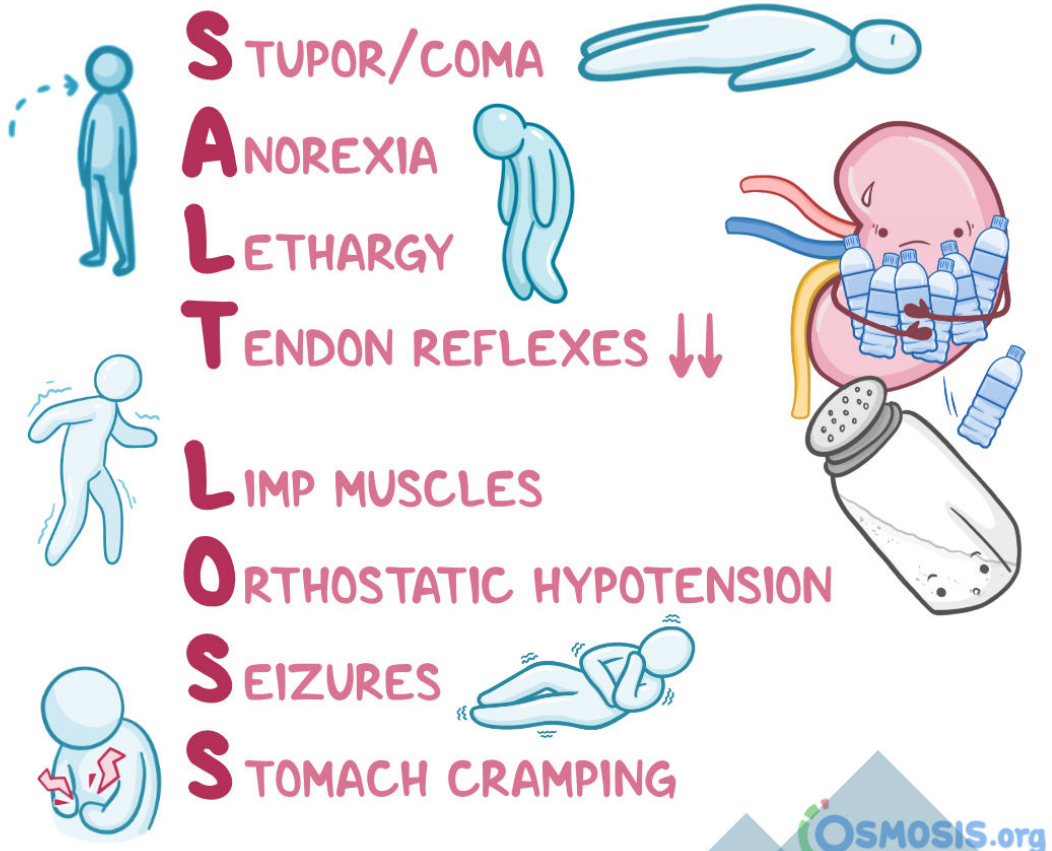

CAUSES:
Many possible conditions and lifestyle factors can lead to hyponatremia
Excessive Vomiting
Diuretics
Drinking too much water
Excessive Diarrhea
Heart, kidney and liver problems
Dehydration
Inadequate Salt Intake
Fluid shift from ICF to ECF
Source:
http://www.mayoclinic.org/diseases-conditions/hyponatremia/
https://www.clinicalkey.com/topics/nephrology/hyponatremia.html
NursingGuide.ph

Signs & symptoms

- Nausea and vomiting
- Headache
- Confusion
- Loss of energy, drowsiness and fatigue
- Restlessness and irritability
- Muscle weakness
- spasms or cramps
- Seizures
- Coma

Signs & symptoms

- Headache
- Muscle weakness
- Spasms or cramps
- Seizures
- In severe hyponatremia: mental confusion, delirium, shock and coma



Complication

- In acute hyponatremia, sodium levels drop rapidly
  - — resulting in potentially dangerous effects, such as rapid brain swelling, which can result in a coma and death.

Medical management

- Determine cause.
- If fluid volume is excess, intake of fluids will be restricted to allow the sodium to regain balance.
- Na <125 mEq/L, sodium replacement is needed.
    - Moderate hyponatremia 125 mEq/ L – IV solution (0.9% NaCl) or RL solution.
    - Na level is 115 mEq / L or less, a concentrated saline solution such as 3 % NaCl is indicated.

Nursing management

- Monitor cardiovascular, respiratory, neuromuscular, cerebral, renal, and gastrointestinal status of the client.
  - ➢ Monitor VS & CVP
  - ➢ Weigh client daily.
  - ➢ Neck and peripheral vein distention, pitting edema, and dyspnea.

➢ Auscultate lung and heart sounds.

➢ Monitor intake and output.

➢ Monitor infusion rate of parenteral fluids closely

HYPERNATREMIA

Hypernatremia is an electrolyte imbalance and is indicated by a high level of sodium in the blood. The normal adult value for Na is 135-145mEq/L. It implies a deficit of total body water relative to total body Na, caused by water intake being less than water losses

Causes

- Impaired thirst: eg - primary hypodipsia
- Excessive Na+ retention, salt intake
- Hyperventilation
- Obstructive uropathy
- Heavy exercise, exertion
- Drugs such – as steroids, and certain blood pressure-lowering medicines.
- Administration of hypertonic enteral feedings without adequate water supplements.
- Less intake

Clinical manifestation

Management

- Correct water deficit
- Rate of correction :
  - ❖Acute hypernatremia- 1mEq/L/hr
  - ❖Chronic hypernatremia-1mEq/L/hr or 10mEq/L over 24hr

Rapid correction may lead to cerebral edema

Complications

- Cerebral bleeding
- Cerebral edema
- Subarachnoid hemorrhage
- Permanent brain damage
- Death due to brain shrinkage

Nursing concern

- Fever, tachycardia, decreased blood pressure,
- Poor skin turgor; flushed skin color; dry mucous membranes and a rough, dry tongue
- Tremors, seizures, and rigid paralysis
- Safety measures for the patient

Meaning- Hypokalemia is a serum potassium level less than 3.5 mEq. /L

Ethiology

- Decreased potassium intake
- Increased losses or shifts in intracellular and extracellular distribution.

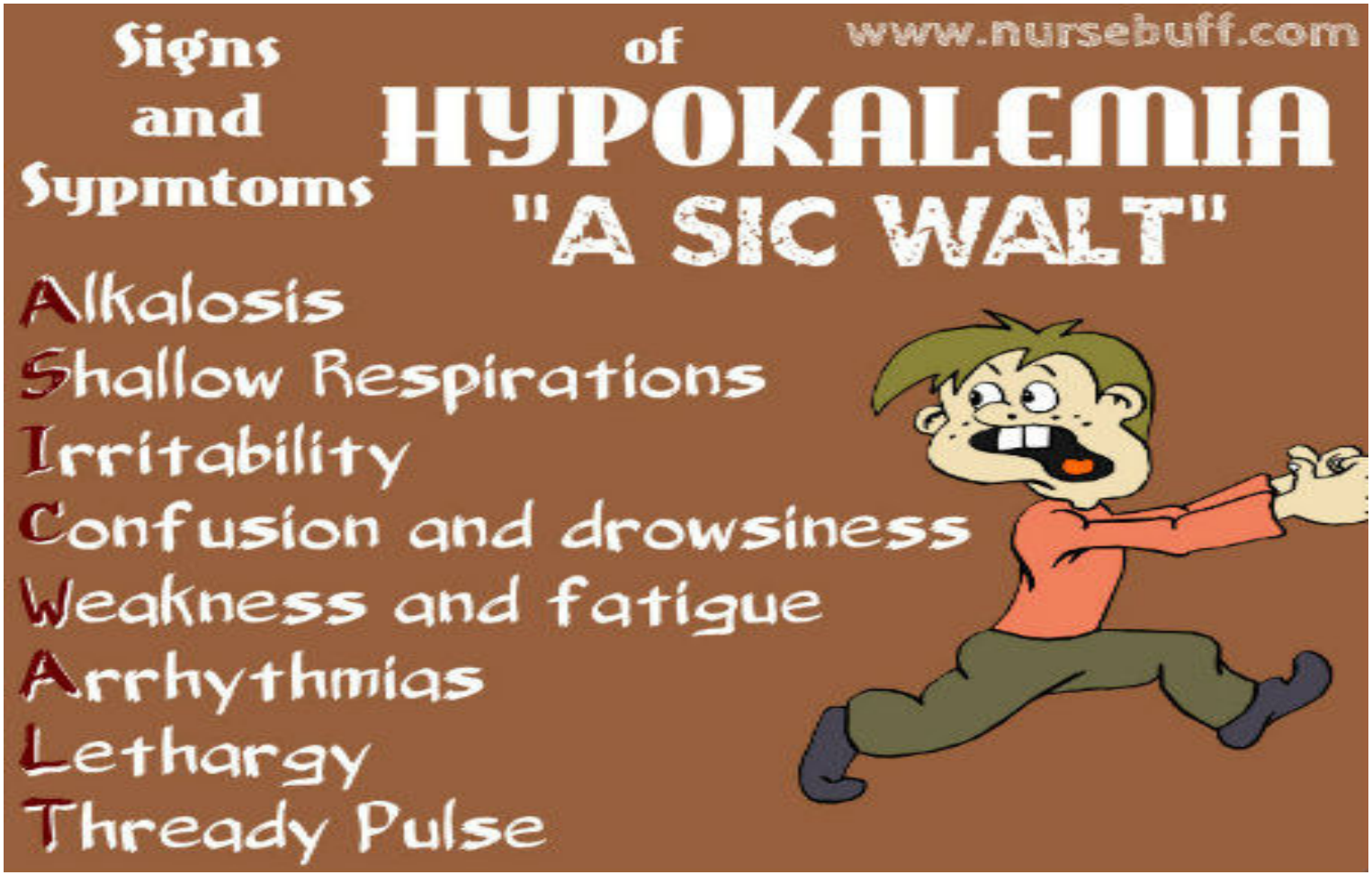
❖G I - Prolonged diarrhea, Vomiting, Excessive use of laxatives

❖Renal

- Diuretic therapy
- Urinary loss in congestive heart failure
- Hypomagnesaemia

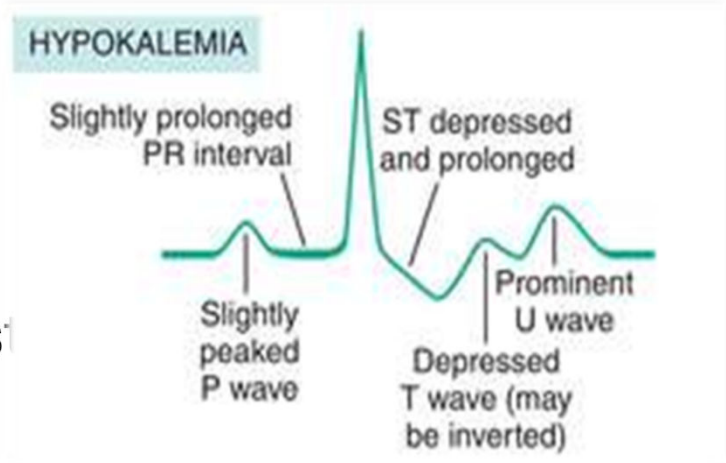
- Primary or secondary hyperaldosteronism
- Cushing's syndrome or disease
- Large doses of corticosteroids

Signs and symptoms



Laboratory & diagnostic findings

- Serum potassium levels less than 3.5 mEqL
- ECG changes- flat/inverted T waves, depressed ST segment, elevated U wave
- Metabolic alkalosis
- Urinary potassium excretion tes exceeding 20 mEq/day



Management

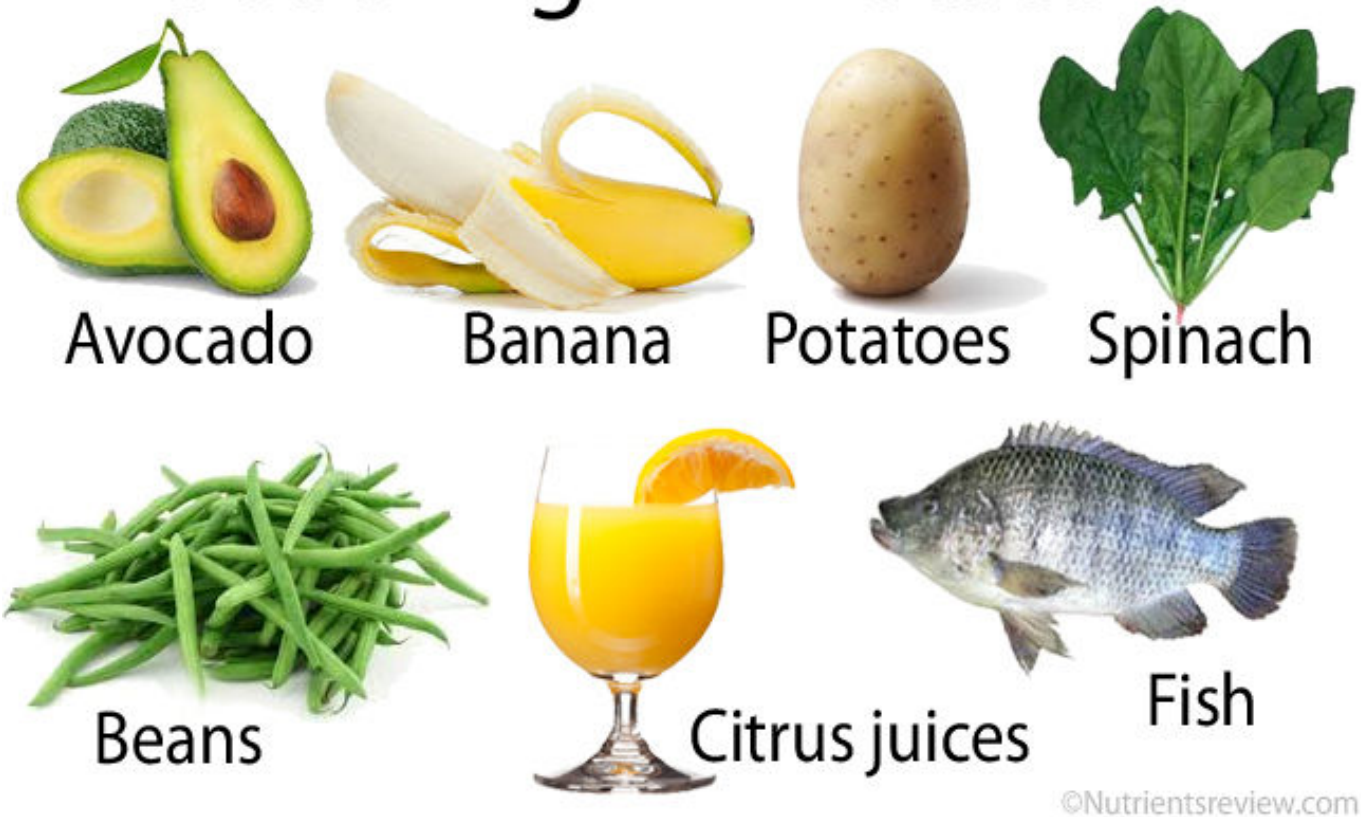
Medical management

- Determining & correcting the cause of the imbalance.
- Extreme hypokalemia requires cardiac monitoring

Pharmacological management

- Oral potassium replacement - mild hypokalemia. (irritating to gastric mucosa -with Glass of water or juice).
- Sk IV for moderate or severe hypokalemia
- Can be given in doses of 10 to 20 mEq/ hr. diluted

Foods High in Potassium



Nursing assessment

- Identify ECG changes.
- Observe for dehydration
- Observe for neuromuscular - fatigue and muscular weakness.

Complications

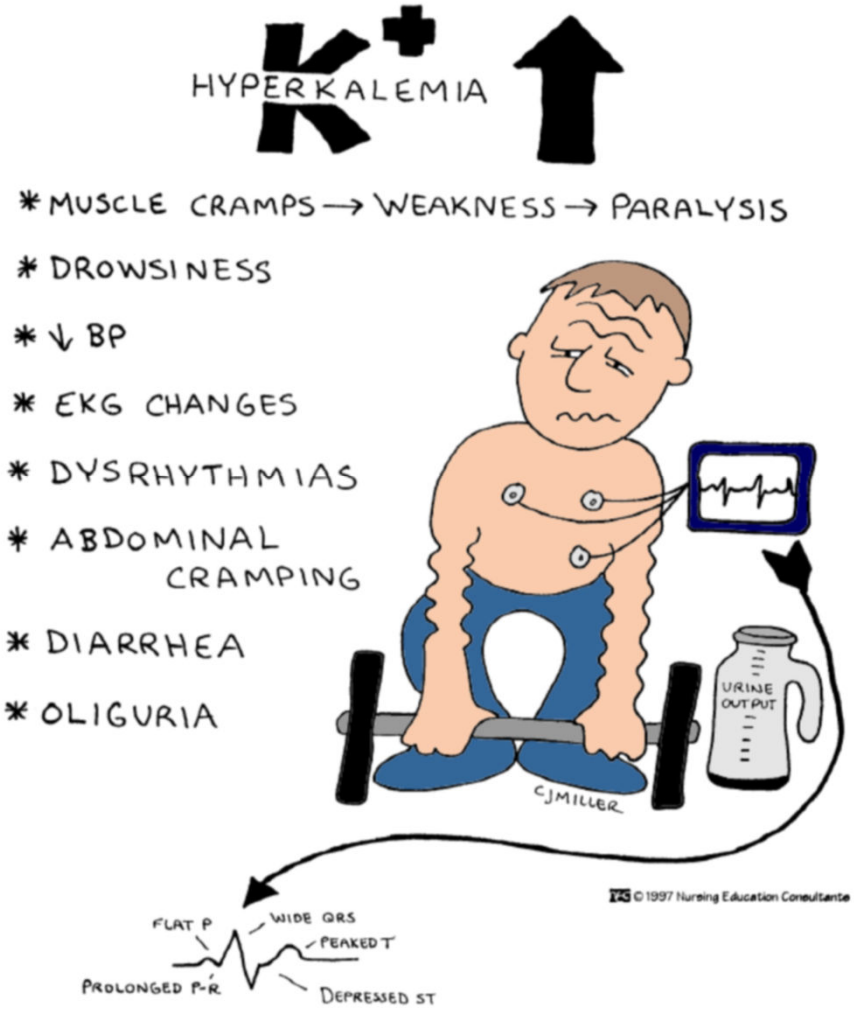
- Heart problems
- Paralysis

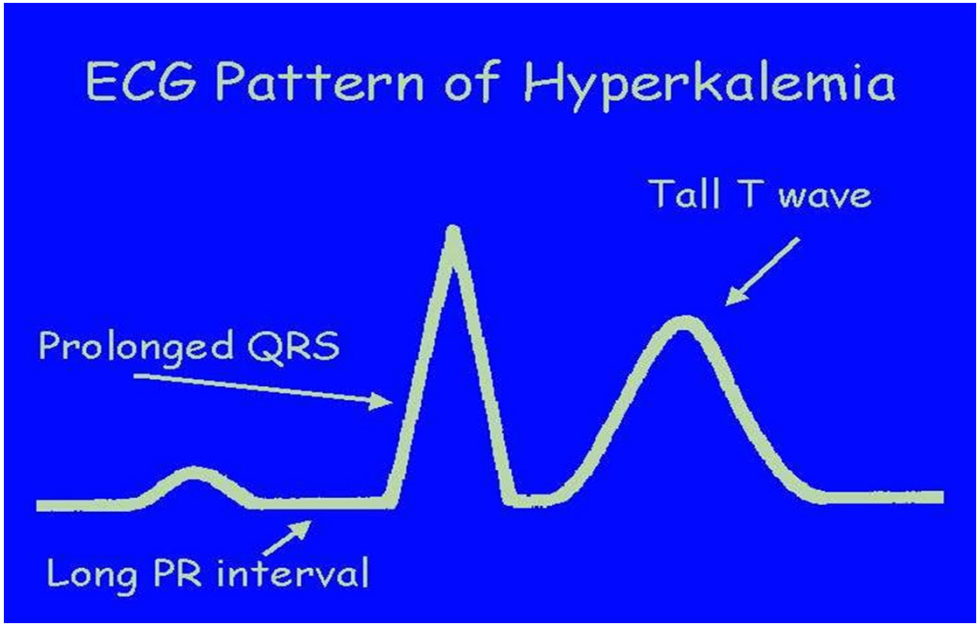
Hyperkalemia is an Elevated potassium level over 5.0 mEq/L.

ETIOLOGY

- Retention of Potassium- Renal insufficiency, renal failure,
- Decreased urine output, potassium sparing diuretics.
- Excessive release of Cellular Potassium - severe traumatic injuries.

  Severe burns, severe infection, metabolic acidosis.
- Excessive IV infusions or Oral administration of potassium.

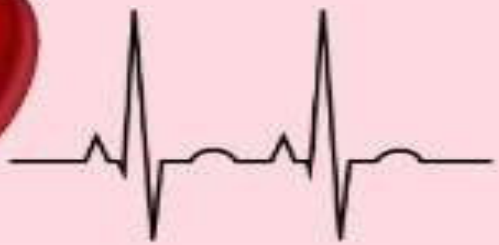

HYPERKALEMIA
K+
* MUSCLE CRAMPS → WEAKNESS → PARALYSIS
* DROWSINESS
* ↓ BP
* EKG CHANGES
* DYSRHYTHMIAS
* ABDOMINAL CRAMPING
* DIARRHEA
* OLIGURIA
URINE OUTPUT
CJMILLER
© 1997 Nursing Education Consultants
FLAT P
WIDE QRS
PEAKED T
PROLONGED P-R
DEPRESSED ST


ECG Pattern of Hyperkalemia
Tall T wave
Prolonged QRS
Long PR interval

HYPERKALEMIA
M-U-R-D-E-R

SIGNS AND SYMPTOMS

M-uscle cramps
U-rine abnormalities
R-espiratory distress
D-ecreased cardiac contractility
E-KG changes
R-eflexes

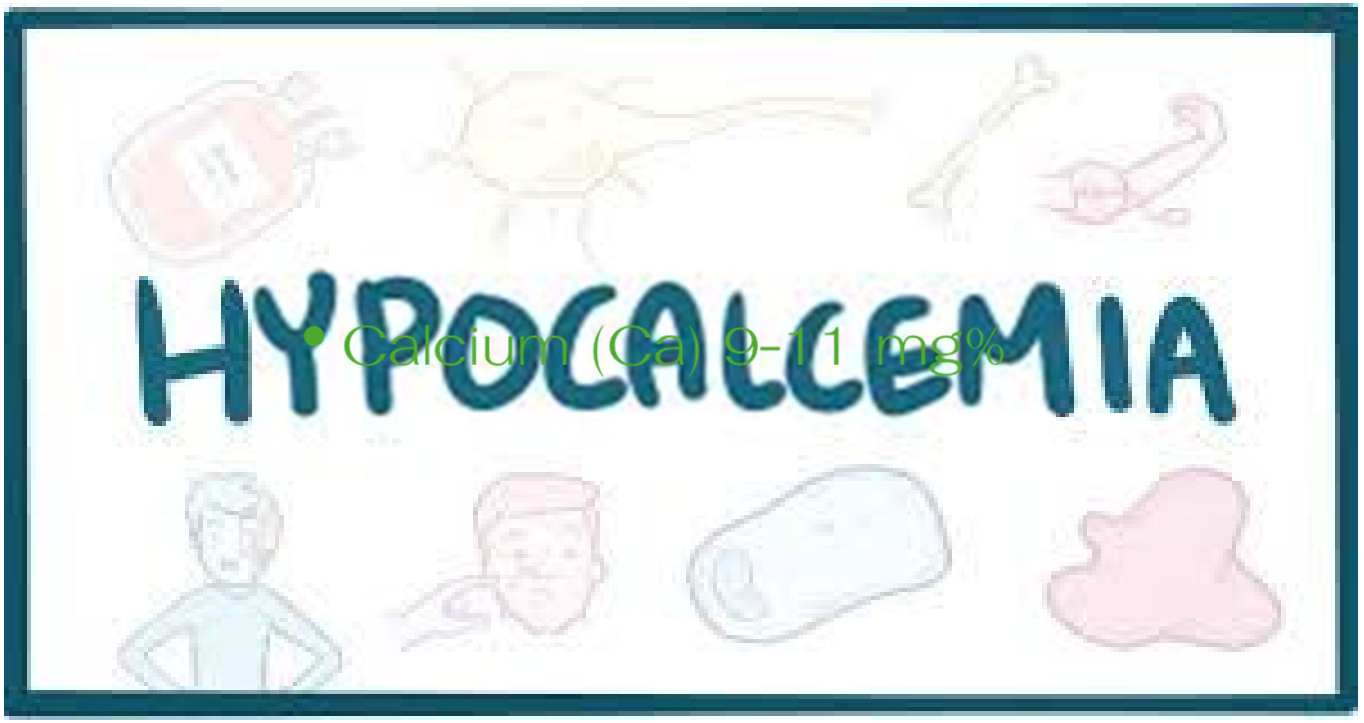


www.nursebuff.com

Medical management

- 5.0 to 5.5 mEq/L - restrict potassium intake.
- If due to metabolic acidosis,- correct acidosis with sodium bicarbonate promotes potassium uptake into the cells.
- Diuretics- Improving urine output decreases elevated serum potassium level
- Insulin

Low Potassium Foods



Total serum level of less than 8.5 mg/dl Calcium (Ca) 9-11 mg%

It can result for decreased total body calcium stores or low levels of extracellular calcium with normal amounts of Calcium stored in bones.

Causes

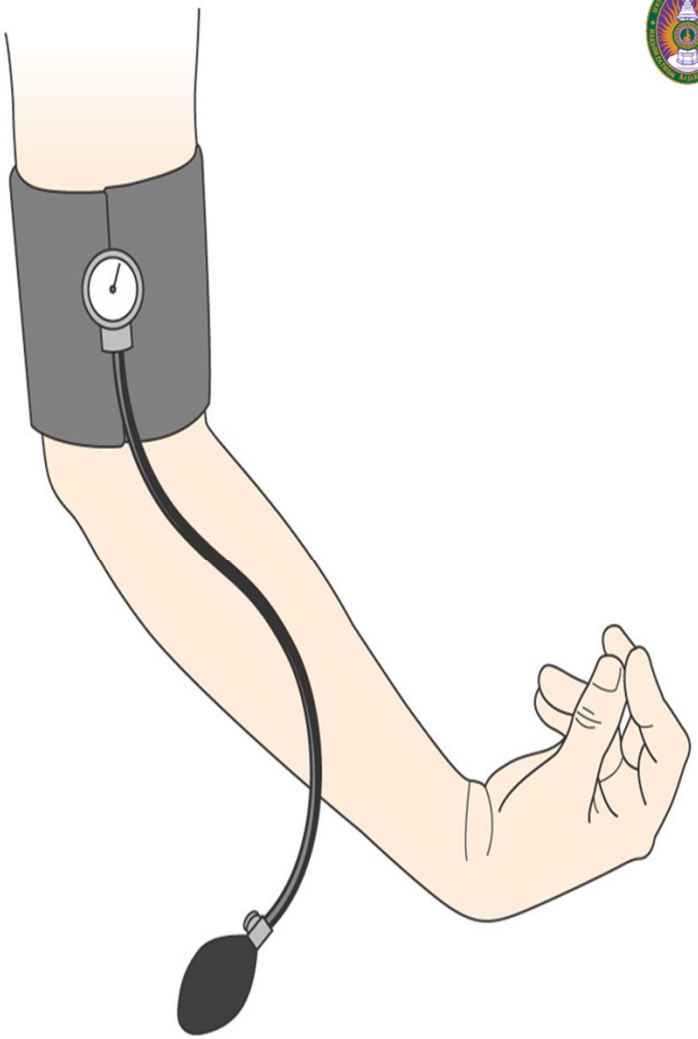
- Parathyroidectomy
- Acute Pancreatitis
- Inadequate dietary intake
- Lack of sun exposure
- Lack of weight bearing exercise
- Drugs: Loop diuretics, calcitonin
- Hypomagnesemia, alcohol abuse

Clinical manifestation

- **Chvostek's Sign** -is the contraction of the facial muscle that is produced by tapping the facial nerve in front of the ear.

- **Trosseau's Sign** - is a carpal spasm that occurs by inflating a BP cuff on the upper arm to 20mmHg greater than systolic pressure for 2-5 mins.

A. Positive Chvostek's Sign



B. Positive Trousseau's Sign

Chvostek's sign

- Facial muscle twitching upon tapping the preauricular region over the facial nerve
- Present at baseline in up to 25% of people

- Tap area 0.5 to 1 cm below the zygomatic process of the temporal bone, 2 cm anterior to the ear lobe, and on a line with the angle of the mandible

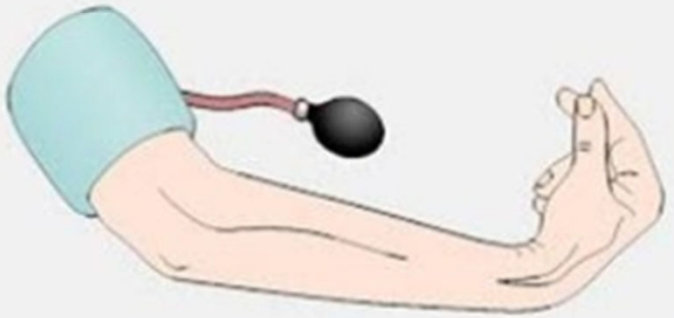
- Other conditions include rickets, diphtheria, measles, scarlet fever and myxedema.

Grading:

1. Twitching of lip at angle of mouth
2. Twitching of alar nasi
3. Twitching of lateral angle of eye
4. Twitching of all facial muscles

Trousseau's sign

- Flexion of the wrist, thumb, and metacarpophalangeal joints and hyperextension of the fingers
- Brachial artery occlusion by inflation of a blood pressure cuff above systolic blood pressure



- More sensitive (94%) than the Chvostek's sign (29%) for hypocalcemia
- Other positive sign is hypomagnesemia

Methods:

- Inflated pressure cuff to a pressure greater than SBP 20 mmHg for 3 minutes to occluded the brachial artery
- Subsequent neuromuscular irritability will induce spasm

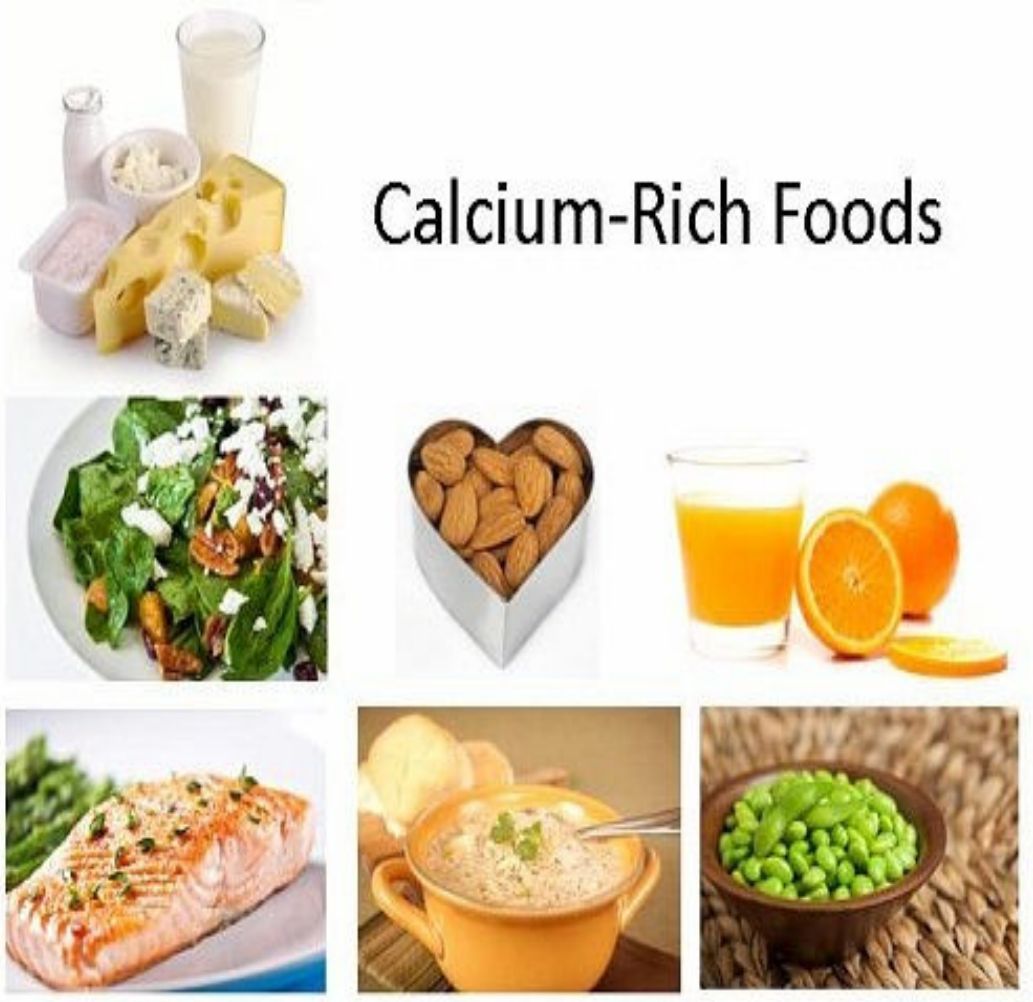
Clinical manifestation

- Muscle spasms
- Laryngospasms
- Seizures
- Anxiety, confusion, psychosis
- Bronchospasm
- Diarrhoea
- Numbness

Management

Pharmacological management

- Oral or intravenous calcium
  - Calcium Chloride
  - Calcium Gluconate
  - Calcium Lactate
  - Calcium Citrate
  - Calcium Gluceptate
  - Calcium Carbonate

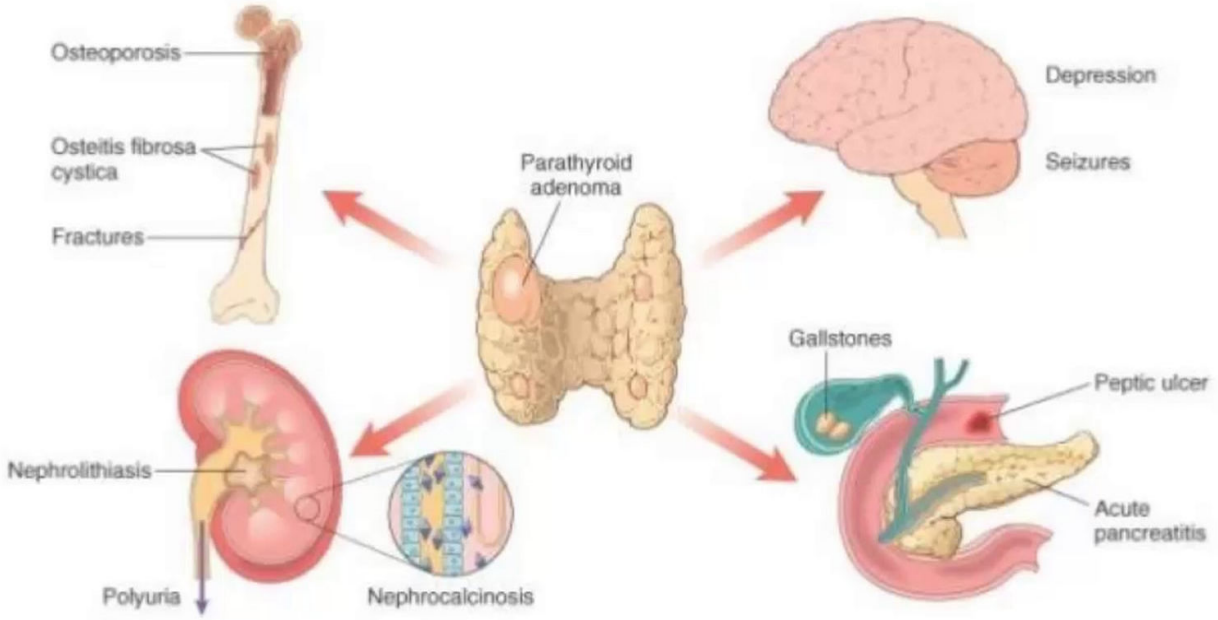


- cottage cheese
- Cheese
- Milk
- Cream
- Yogurt
- ice cream
- Spinach

Nursing managements

- Fatigue
- Tingling/numbness; fingers l
- Abdominal cramps
- Palpitations
- Dyspnea
- Muscle spasms

Hypercalcemia



- Serum calcium value greater than 10.2 mg/dl
- Usually results from increased absorption of calcium from the bones and intestines.

Contributing factors

- Excessive calcium intake
- Excessive vitamin D intake
- Renal failure
- Hyperparathyroidism
- Malignancy
- Hyperthyroidism

Clinical manifestations

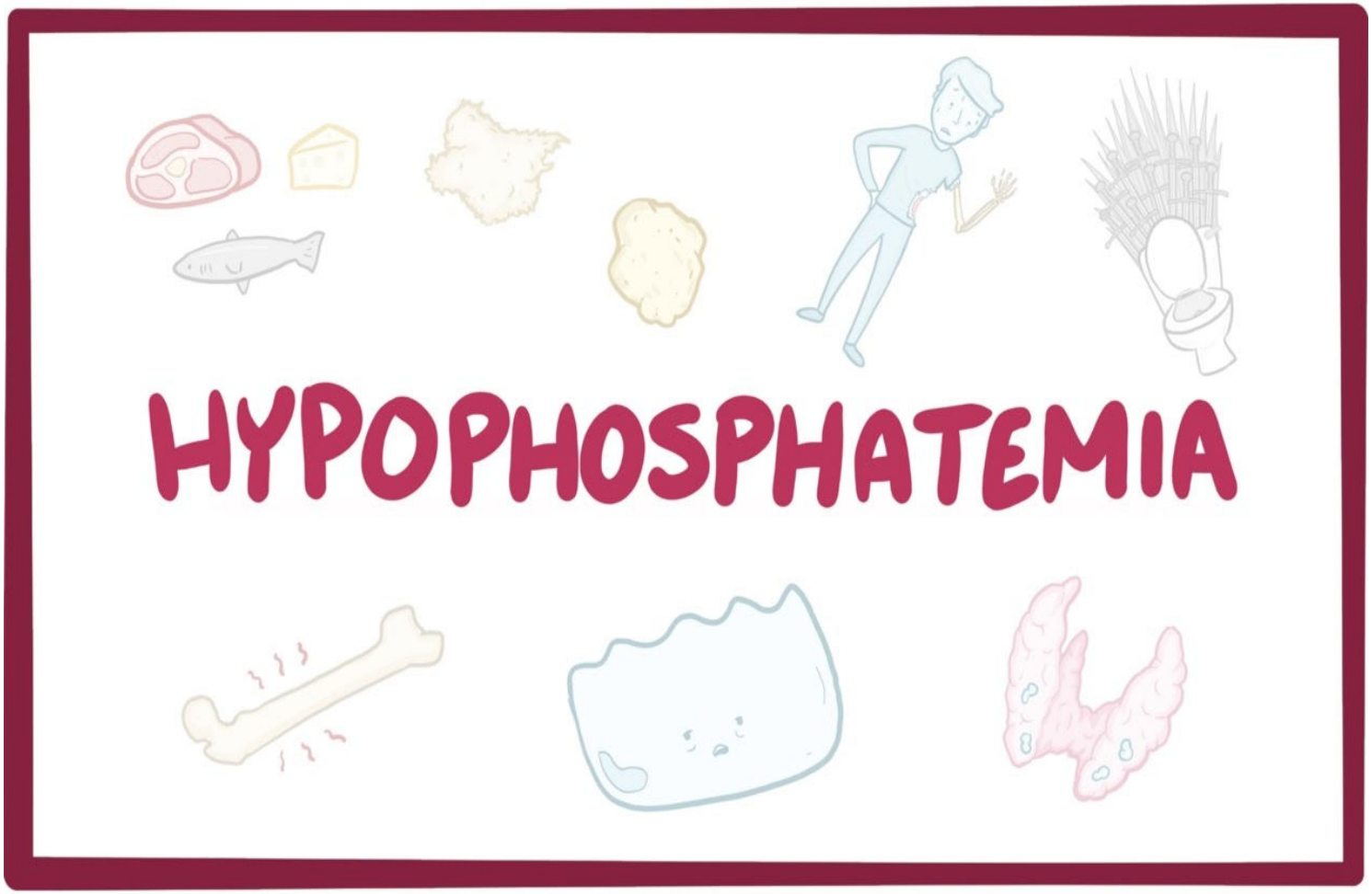
- Muscular weakness
- Constipation
- Anorexia
- Nausea & vomiting
- Dehydration
- Hypoactive deep tendon reflexes
- Calcium stones

Management

- Eliminate calcium administration
- Drug Therapy
- Isotonic NaCl (Inc. the excretion of Ca)
- Diuretics
- Calcium reabsorption inhibitors (Phosphorus)
- Cardiac Monitoring
- Restrict calcium intake

Nursing management

- Increasing patient mobility and encouraging fluids
- Encourage to drink 2.8 to 3.8L of fluid daily
- Adequate fiber in diet is encouraged
- Safety precaution are implemented



Hypophosphatemia is an electrolyte disturbance in which there is an abnormally low level of phosphate in the blood. Hypophosphatemia is defined as:

- Mild 2-2.5 mg/dL
- Moderate 1-2 mg/dL
- Severe < 1 mg/dL

Etiology and risk factors

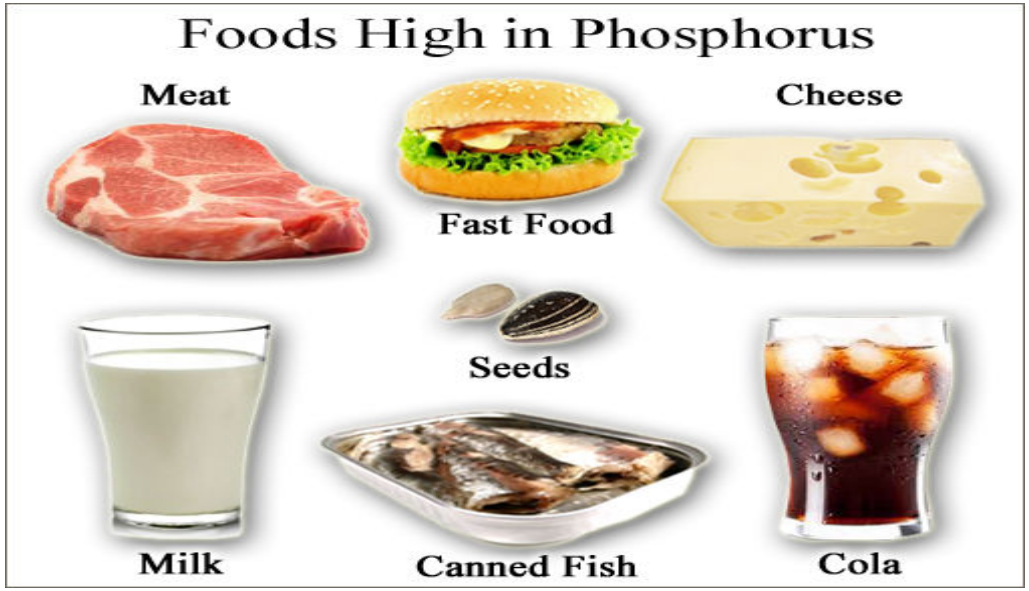
- loss or long term lack of intake
- increased growth or tissue repair and recovery from malnourished states.
- Prolonged and excessive intake of antacids.
- Increased calcium found in hyperparathyroidism.
- Phosphate loss occurring in burns and metabolic alkalosis

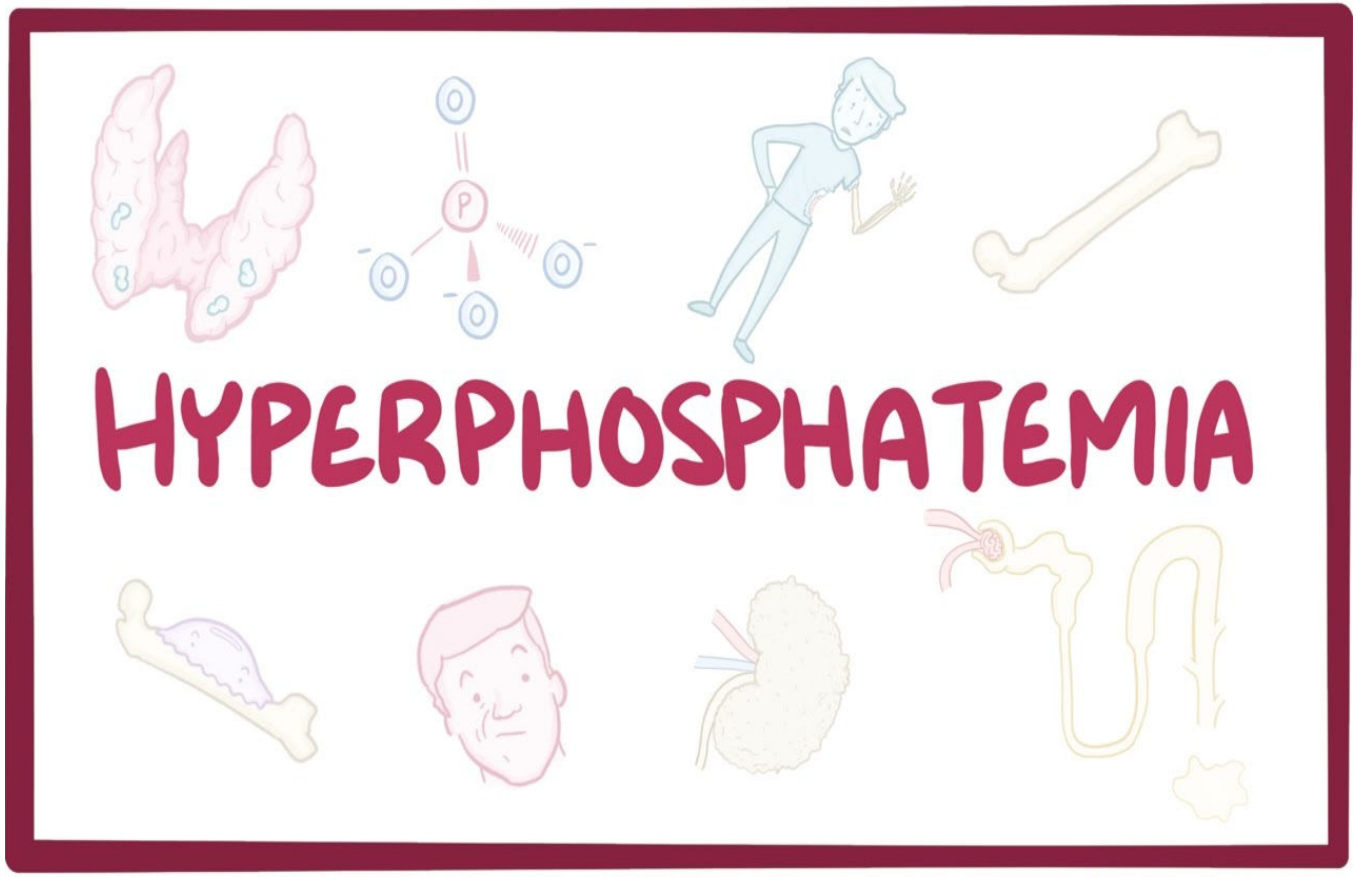
Clinical manifestations

- Decreased cardiac and respiratory functions
- Muscle weakness
- Brittle bones, bone pain
- Confusion and seizure

Management

- Diet and dietary supplementation
- Total parenteral nutrition is the intervention till the phosphate level become stable





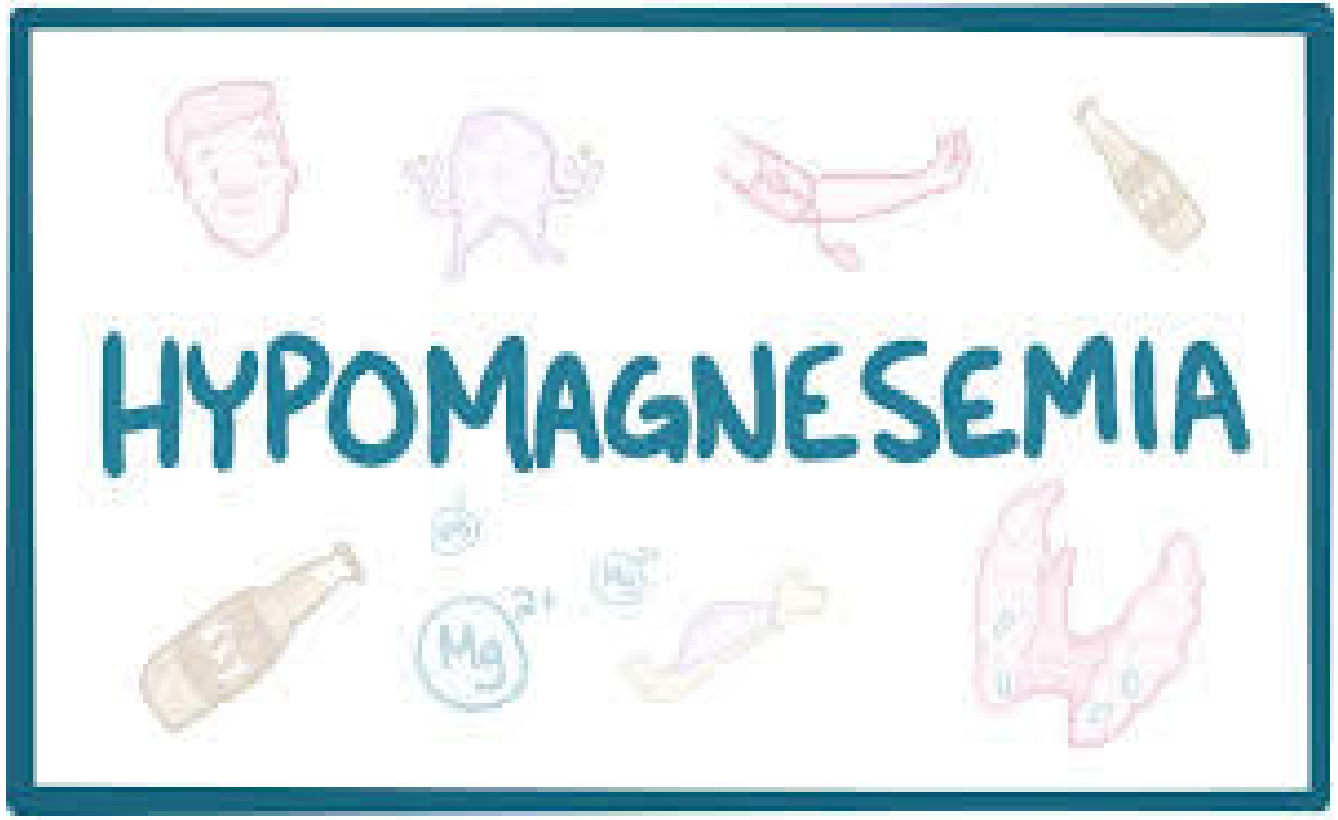
Serum phosphate concentration > 4.5 mg/dL

Clinical manifestations

- Tachycardia, palpitations and restlessness.
- Anorexia, nausea, vomiting.
- Tetany, serious dysrrythmias.
- All the clinical features of hypocalcemia

Management

Mild hyper phosphatemia	moderate Hyper phosphatemia	Severe, renal failure
limiting the high phosphate foods like Milk and Milk products	calcium or Aluminum products that promotes the binding and excretion of phosphate.	DIALYSIS



levels less than 1.46 mg/dL (0.6 mmol/L)

Normal magnesium levels are between 1.46–2.68 mg/dL (0.6-1.1 mmol/L)

Etiological factors

Other electrolyte imbalances

critically ill and alcoholics

malnutrition; Mal-absorption syndromes

hyperglycemia

IV or TNP therapy without magnesium replacement

acute renal failure

phosphorus in the intestine

medications

Estrogen therapy

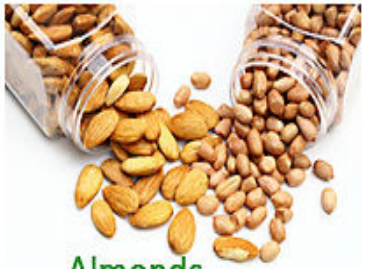
Clinical manifestations

- Myocardial irritability
- GI changes from decreased contractility
- Neuromuscular changes
- Cardiac abnormalities

Management

- oral magnesium replacement in the form of magnesium-containing antacids or parenteral magnesium sulfate.
- Increase in dietary intake of magnesium

Magnesium Rich Foods



Almonds

Spinach

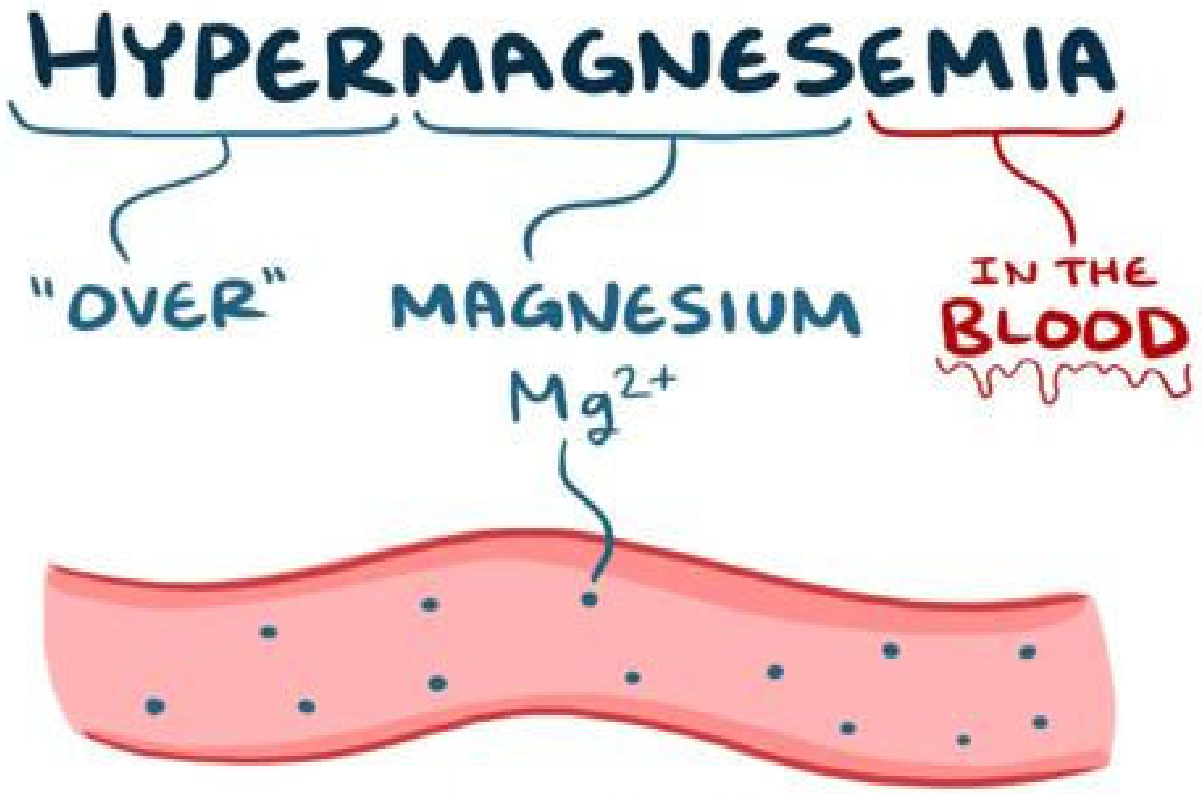
Soybeans

Avocados

Potatoes

Brown Rice

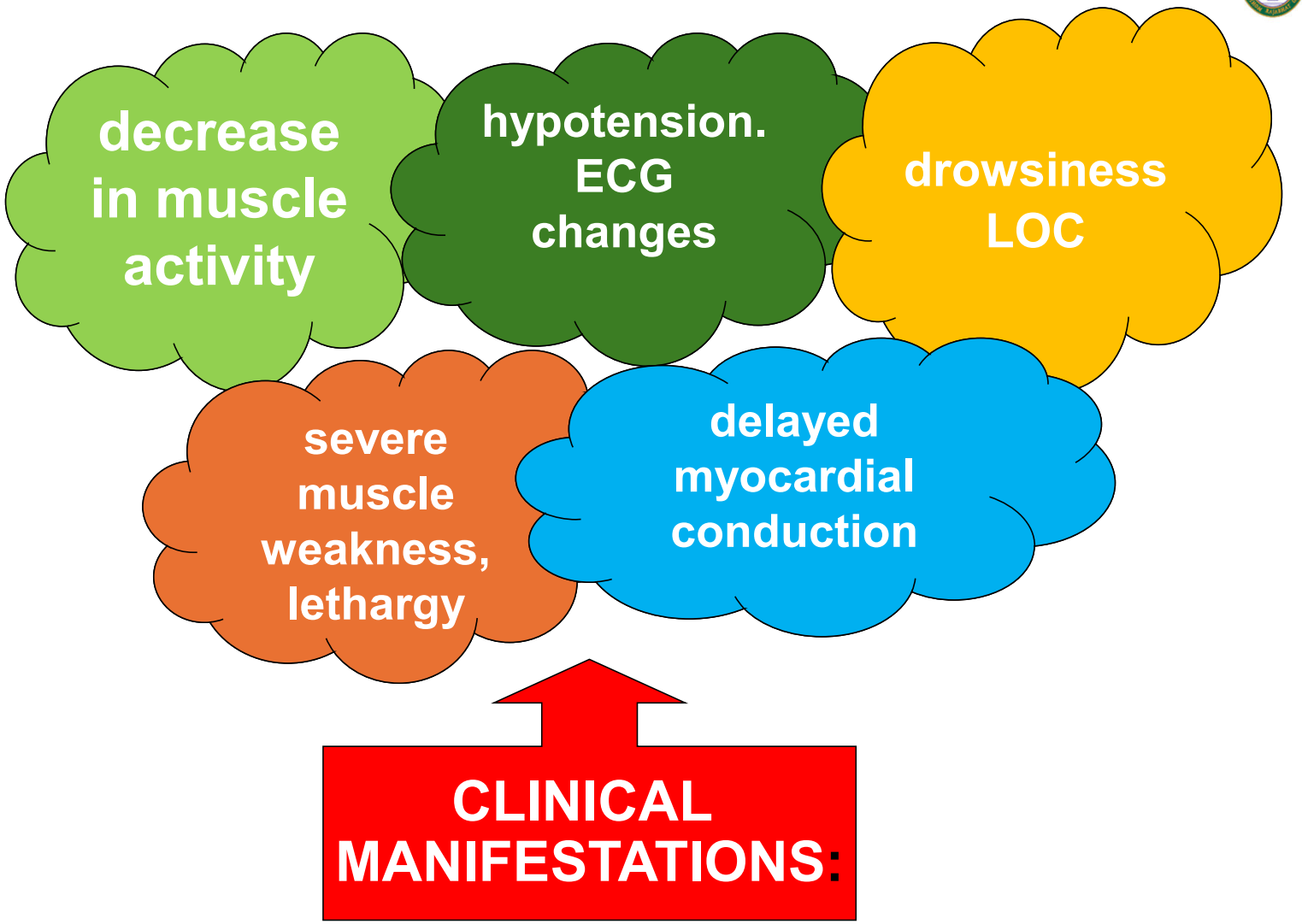
Cashews



- levels greater than 2.68 mg/dL (1.1 mmol/L)

Etiology and risk factors

- renal insufficiency
- excessive use of magnesium-containing antacids or laxatives
- administration of potassium sparing diuretics
- severe dehydration from ketoacidosis
- overuse of IV magnesium sulfate


decrease in muscle activity
hypotension. ECG changes
drowsiness LOC
severe muscle weakness, lethargy
delayed myocardial conduction
CLINICAL MANIFESTATIONS:

Management

- Decreasing the use of magnesium sulfate.
- Diuretic increases renal elimination of magnesium.
- IV calcium may also be used ot antagonize the effect of hypermagnesemis.
- Albuterol has also been used to reduce magnesium levels.
- The presence of severe respiratory distresses require ventilatory assistance.
- If renal failure is present, hemodialysis may be necessary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