ELECTROLYTE IMBALANCE

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INTRODUCTION

- Body is formed by solids and fluids. Fluid part is more than two third of the whole body. Fluids, electrolyte and acid base balances within the body maintain health and function in all body system. These balances are maintained by the intake and output of water and electrolytes, their distribution in the body, and regulated by the renal and pulmonary system.

water forms most of the fluid part of the body. Water balance is the balance between water intake and water output. Water is the single largest component of the body; the proportion of water is lower in women, obese, and older adults but higher in children.

In a normal young adult male, body contains 60% to 65% of water and 35% to 40% of solids.

In a normal young adult female, body contains 50% to 55% of water and 45% to 50% of solids.

In females water is less because of more amount of subcutaneous adipose tissue. In thin person, water content is more than that in obese person. In old age, water content is decreased due to increase in adipose tissue . Total quantity of body water in an average human being weighing about 70 kg is about 40L.

A healthy active, well oriented adult usually maintains normal fluid, electrolyte and acid base balances because of body's adaptive physiological mechanisms. Physical, behavioural, and environmental factors affects the body ability to regulate fluid, electrolyte and acid base balances. Imbalances results from illnesses, altered fluid intake and prolonged episodes of vomiting and diarrhoea.

DISTRIBUTION OF BODY FLUIDS :

Total water in the body is about 40L. It is distributed into two major compartment:

1)Intracellular fluid (ICF)

2)Extracellular fluid (ECF)

1)INTRACELLULAR FLUID (ICF) :-

Intracellular fluids (ICF) comprises all fluids within the cells of the body, about 40% of total body weight. Approximately 2/3^{rds} of our total body water.

Approximately:- 28L in average male , 20L in the average in female , is ICF.

2)EXTRACELLULAR FLUID (ECF) :-

Extracellular fluids (ECF) is all the fluid outside a cell , which is divided into three smaller compartments :

A) Interstitial fluid

B) Vascular fluid

C) Transcellular fluid

CONT…..

Extracellular fluid makes up to 20% of total body weight or 1/3rd of total body water.

- ✓ Interstitial fluid , which contains lymph , is the fluid between the cells and outside the blood vessels.
- ✓ Intravascular fluid is blood plasma found in the vascular system.
- ✓ Transcellular fluid : its include :

a) Cerebrospinal fluid
b) Intraocular fluid
c) Digestive juices
d) Serous fluid
e) Synovial fluid in joint
f) Fluid in urinary tract

COMPOSITION OF BODY FLUIDS :

The body fluids i.e. extracellular fluid and intracellular fluid , contain electrolytes , minerals and cells.

An electrolyte is an element or compound that , when dissolved and dissociated in water or other solvent , separate into ions that are electrically charged.

- Positively charged electrolytes are cations. Eg :sodium (Na^+) potassium (K^+) calcium (Ca^{2+}).
- Negatively charged electrolytes are anions. Eg : chloride (Cl^-) bicarbonate(HCO_3^-) , sulphate (So_4^-)

It is important and essential for health for health that fluid volume and electrolyte accumulations remain equal in all compartment.

DISTRIBUTION OF ELECTROLYTES :

ELECTROLYTES	EXTRACELLULAR
Sodium	135-145 meq/l
Potassium	3.5-5.0 meq/l
Ionized calcium	4.5-5.5 mg/dl
Bicarbonate	22-26 (arterial) meq/l 24-30 (venous) meq/l
Chloride	95-105meq/l
Magnesium	1.5-2.5 meq/l
Phosphate	2.8-4.5mg/dl

Electrolytes are vital to body functions. The value milliequivalents per litre (meq/l) represents the number of grams of the specific electrolyte (solute) dissolved in a litre of plasma (solution).

in the body water is solvent and the solutes are electrolytes oxygen, carbon dioxide, glucose and protein.

- Minerals are constituents of all body tissues and fluids and are important in maintaining physiological processes. Minerals also act as catalysts in nerve response , muscle contraction and metabolism of nutrients.
- Cells are the basic functional unit of all living tissues.

a) Red blood cells

b) White blood cells

c) Platelets are the main examples.

MOVEMENT OF BODY FLUID :

Each body compartment is separated by a cell wall and capillary membrane . Fluids and electrolytes constantly shift from compartment to compartment to facilitate body processes such as tissue oxygenation ,acid-base balance , and urine formation.

Fluids and solutes move across these membranes by four process :-

1. Osmosis
2. Diffusion
3. Filtration
4. Active transport

REGULATION OF ELECTROLYTE :

fluid intake , hormonal controls, and fluid output regulate body fluids. This physiological balance is termed homeostasis.

Cations :

major cations within the body fluids include sodium , potassium, calcium, magnesium.

- Sodium regulation :

-most abundant cation (90%) in ECF.

-maintaining water balance , nerve impulse transmission , regulation of acid-base balance and participation in cellular chemical reactions.

- sodium intake is regulated by dietary intake and aldosterone secretion.

-concentration is 135-145 meq/l

- Potassium regulation :

- the major electrolyte and principal cation

- regulates many metabolic activities and necessary for glycogen deposits in the liver , skeletal muscle and transmission.

-the normal range serum potassium concentration is 3.5 to 5 meq/l dietary intake and renal excretion.

- Calcium regulation :

-stored in bone , plasma and body cells.

-located in bone , and only 1% in ECF.

-normal serum ionized calcium is 4.5 - 5.5 mg/dl

-normal total calcium is 8.5-10.5

- necessary for bone and teeth formation , blood clotting, hormone secretion, cell membrane integrity , cardiac conduction , transmission of nerve impulse and muscle contraction.

- Magnesium regulation :

- essential for enzyme activities, neurochemical activities and cardiac and skeletal muscle excitability.

-plasma concentrations of magnesium range from 1.5-2.5 meq/l

-regulated by dietary intake, renal mechanism and action of PTH.

-50-60% is contain within the bone and 1% in ECF and the remaining is located inside the cell.

ANIONS :

the three major anions of body fluids are chloride, bicarbonate and phosphate ions.

- Chloride regulation:
  - -major anion in ECF.
  - - transport of chloride follows sodium.
  - -normal range 95-105 meq/l
  - -regulated by dietary intake and the kidneys.

- Bicarbonate regulation :
  - - major chemicals base buffer within the body.
  - - found in both ECF and ICF.
  - - bicarbonate buffering system essential to acid-base balance.
  - - normal range arterial - 22-26 meq/l
    venous - 24-30meq/l

- Phosphorus-phosphate regulation :

  -all the phosphorus in the body exists in the form of phosphate.

  -it is a buffer anion found in ICF, small amount found in ECF.

  -it assist in acid-base regulation

  -phosphate and calcium help to develop and maintain bone and teeth.

  -phosphate and calcium are inversely proportional:

  if one rises , the other falls.

  -absorbed through GI tract.

  - regulated by dietary intake, renal excretion, intestinal absorption and PTH.

  -normal serum level 2.8-4.5 mg/dl

ELECTROLYTE IMBALANCES

- Whenever body looses fluid through increased urination, defecation or sweating, the electrolytes also lost.

Sodium imbalance:

-loss of sodium is regulated by kidneys.

-body initially adapts by reduction water excretion to maintain the serum osmolality at near normal levels.

-if loss continues, the body attempts to preserve the blood volume, as a result the proportion of sodium in the ECF lessens.

1)hyponatremia:

-lower than normal concentration of sodium in the blood.

-caused by sodium loss can result in vascular collapse and shock.

-severe can result in neurological changes at a level of 120 meq/l.

-irreversible neurological alterations or death at 110 meq/l.

- causes:

- GI losses
  -severe prolonged diarrhoea.
  -gastric and intestinal suction.
  -draining pancreatic fistula.
- Prolonged and excessive sweating.
- Kidney disease.
- Adrenal insufficiency.
- Prolonged use of strong diuretics.
- intake of water in excess of the intake of sodium.
- Interruption of sodium-potassium pump.
- Metabolic acidosis.
- Psychogenic polydipsia.
- Syndrome of inappropriate ADH.

- Signs and symptoms:
- Physical examination

-apprehension

-personality change

-postural hypotension

-postural dizziness

-abdominal cramping

-nausea and vomiting

-diarrhoea

-tachycardia.

-dry mucous membrane

-convulsion and coma.

Laboratory findings:

-serum sodium level below 135 meq/l.

-serum osmolality 280 mOsm/kg.

-urine specific gravity below 1.010.

-plasma chlorides below 98 meq/l.

- Hypernatremia:

  -Greater than normal concentration of sodium in ECF.

  -Caused by excess water loss or an overall sodium excess.

  -In hypernatremia body conserves as much water as possible through renal absorption.

Causes:

-Excess salt intake.

-Excess aldosterone secretion.

-Diabetes insipidus.

-increased sensible and insensible water loss.

-water deprivation.

Signs and symptoms:

-Extreme thirst.

-Dry and flushed skin.

-Dry and sticky tongue and mucous membrane.

-postural hypotension.

-Fever.

-Agitations.

-Convulsion.

-Restlessness.

-Irritability.

Laboratory findings:

-Serum sodium levels above 145 meq/l

-serum osmolality 300 mOsm/kg.

-urine specific gravity 1.030.

-plasma chloride more than 106 meq/l

- Potassium imbalance:

Hypokalaemia:

-Most common type of electrolyte imbalances.

-Inadequate amount of potassium in ECF.

-Severe hypokalaemia affects cardiac conduction and function.

Causes:

-Use of potassium-wasting diuretics.

-Diarrhoea, vomiting, or other GI losses.

-Alkalosis.

-Excess aldosterone secretion.

-Polyuria.

-extreme sweating.

-excessive use potassium free IV solutions.

-Treatment of diabetic ketoacidosis with insulin.

Cushing syndrome

- Signs and symptoms:
- physical examination
  -Weakness and fatigue.
  -muscle weakness.
  -Nausea and vomiting.
  -Intestinal distention.
  -Decreased bowel sound.
  -Decreased deep tendon reflexes.
  -Ventricular dysrhythmias.
  -Irregular pulse.

- Laboratory findings:
  -Serum potassium level below 3.5 mEq/L.
  -ECG abnormalities: flattened T wave: ST segment depression: U wave: potentiated digoxin effects.

Eg: ventricular dysrhythmias.

- Hyperkalaemia:
  -Greater than normal amount of potassium in blood.
  -If severe produce marked cardiac conduction abnormality.

Causes:

-Renal failure.
-Fluid volume deficit.
-massive cellular damage (burns and trauma)
-Iatrogenic administration of large amount of potassium.
-Adrenal insufficiency.
-Acidosis, specially diabetic ketoacidosis.
-Rapid infusion of stored blood.
-Use of potassium sparing diuretics.
-Ingestion of potassium salt substitutes.

- Signs and symptoms:
- Physical examination

  -Anxiety

  -dysrhythmias.

  -Paraesthesia.

  -Weakness.

  -Abdominal cramps.

  - Diarrhoea.

- Laboratory Findings:

  -Serum potassium level above 5.0 mEq/L.

  -ECG abnormalities: peaked T wave and widened QRS complex (bradycardia, heart block, dysrhythmias); eventually QRS patterns widens and cardiac arrest occurs.

- Calcium imbalance:
- Hypocalcaemia:

  -Represent a drop in total serum and/or ionized serum.

  -Results from illness, which directly affect the thyroid and parathyroid glands.

Causes:

-Rapid administration of blood transfusion containing citrate.

-Hypoalbuminemia.

-Hypoparathyroidism.

-Vitamin D deficiency.

-pancreatitis.

-Alkalosis.

-Chronic renal failure.

-Chronic alcoholism.

-Neoplastic diseases.

- Signs and symptoms:
- Physical Examination:

-Numbness and tingling on fingers and around mouth.

-Hyperactive reflexes.

-Positive trousseaus sign (carpopedal spasm with hypoxia.

-Positive Chvostek's sign (contraction of facial muscle when facial muscle is tapped)

-tetany.

-Muscle cramps.

-Pathological fractures.

Laboratory findings:

-Serum ionized calcium level below 4.5 mEq/L.

-Total serum calcium below 8.5 mg/dl.

-ECG abnormalities: Ventricular tachycardia.

- Hypercalcaemia:

-Increase in the total serum concentration of calcium and ionized calcium.

-It is frequently a symptoms of hyperparathyroidism or neoplasm resulting in excess bone reabsorption with release of calcium.

-Bone loss of calcium also result from prolonged immobilization.

Causes:

-Hyperparathyroidism.

-Osteometastasis.

-Paget's disease.

-Osteoporosis.

-Prolonged immobilization.

-Acidosis.

-Thiazide diuretics.

- Signs and symptoms:
- Physical examination:

-Anorexia.

-Nausea and vomiting.

-Weakness.

-Hypoactive reflexes.

-Lethargy.

-Flank pain

-Decreased level of consciousness.

-Personality changes and

-Cardiac arrest.

Laboratory findings:

-Serum ionized calcium above 5.5 mEq/L or total serum calcium level above 10.5 mg/dl.

-X-ray examination showing Generalized osteoporosis, widespread bone cavitation and radio opaque urinary stones.

-Elevated blood urea nitrogen level 25 mg/100ml.

-elevated creatinine level 1.5mg/100ml. Caused by fluid volume deficit or renal damage, caused by urolithiasis.

-ECG abnormalities: Heart block.

- Magnesium imbalance:
- Hypomagnesemia:

-A drop in serum magnesium occurs with malnutrition and with malabsorption disorders.

Causes:

-Inadequate intake: malnutrition and alcoholism.

-Polyuria.

-Inadequate absorption or loss: Diarrhoea, vomiting, nasogastric drainage, fistulas, disease of small intestine.

-Excessive loss resulting from thiazide diuretics.

-Hypoparathyroidism.

-Aldosterone excess.

- Signs and symptoms:

-Muscular tremors.

-Hyperactive deep tendon reflexes.

-Confusion and disorientation.

-Tachycardia.

-Hypertension.

-Dysrhythmias.

-Positive chvostek's sign.

- positive trousseaus sign.

Laboratory findings: magnesium level below 1,5 mEq/L

- Hypomagnesaemia:

-Increase in serum magnesium levels, which depress skeletal muscles and nerve function.

-Most frequently it is a result of excess magnesium intake in a client with renal insufficiency.

Causes:

-Renal failure.

-Excess oral or parenteral intake of magnesium.

Signs and symptoms:

-Acute elevation in magnesium levels.

-Hyper proactive deep tendon reflexes.

-Decrease depth and rate of respirations.

-hypotension and flushing.

Laboratory findings:

-magnesium level above 2.5 mEq/L.

-ECG abnormalities: prolonged QT interval and AV block.

- Chloride imbalance:
- Hypochloremia:

-occurs when serum chloride balance levels falls below normal.

-Chloride imbalance usually associated with sodium imbalance.

-Vomiting or excessive nasogastric or fistula drainage results in hypochloremia because of the loss of hydrochloric acid.

-Use of Loop and thiazide diuretics also results in increased chloride loss a sodium is excreted.

-When serum chloride levels falls metabolic alkalosis results.

- Hyperchloremia:

-Occurs when serum chloride level rises above normal, which usually occurs when the serum bicarbonate value falls or sodium level rises.

-Hypochloremia and hyperchloremia rarely occurs as a single disease process but commonly associated with acid base imbalance.

FLUID DISTURBANCES

- Fluid Disturbances: Fluid imbalance usually occurs because illness or injury disturbs the body ability to maintain homeostasis.
- Isotonic Imbalance:

1) Fluid volume deficit: water and electrolytes lost in equal or isotonic.

causes:

-GI losses: Diarrhoea, vomiting, Drainage from fistulas and tube.

-Loss of plasma or whole blood such as with haemorrhage, burns, excessive perspiration.

-Fever.

-Decreased oral intake of fluids.

- Confusion or depression.

-use of diuretics.

Signs and symptoms:

- Postural hypotension.

-Tachycardia.

-Dry mucous membrane.

-Poor skin turgor.

- confusion.

-Thirst.

-Rapid weight loss.

-Slow vein filling.

-Flat neck veins.

-Lethargy.

-Oliguria.

-Weak pulse.

Laboratory findings:

-Urine specific gravity above 1.030.

-Increased haematocrit level above 50%.

-Increased BUN level above 25 mg/100ml.

2) Fluid volume excess: Water and sodium retained in isotonic.

Causes:

- -Congestive Heart Failure.
- -Renal Failure.
- -Cirrhosis of liver.
- -Increased serum aldosterone and steroid levels.
- -Excessive sodium intake or administration.

Signs and symptoms:

- -Rapid weight Gain.
- -oedema.
- -Hypertension.
- -polyuria.
- -Neck vein distention.
- -Increased blood and venous pressure.
- -crackles in lungs.
- -confusion.

- Laboratory findings:

  -Decreased haematocrit level below 38%.

  -Decreased BUN level below 10mg/100ml.

- Osmolar imbalances:

1) Hyperosmolar imbalance:

Causes:

-Diabetes insipidus.

-Interruption of neurologically driven thirst drive,

-Diabetic ketoacidosis.

-osmotic diuretics.

-Administration of Hypertonic parenteral or tube feeding formula.

- Signs and symptoms:

  -Dry and sticky mucous membrane.

  -Flushed and dry skin.

  -Thirst.

  -Elevated body temperature.

  -Irritability and convulsion.

  -Coma.

- Laboratory findings:

  -Increased serum sodium level above 145 mEq/L.

  -Increased serum osmolality above 295 mOsm/kg.

2) Hypoosmolar imbalance:

- Causes

  -Syndrome of inappropriate of antidiuretic hormone.

  -Excess water intake.

- Signs and symptoms:

  -Decreased level of consciousness.

  -Convulsion.

  -coma.

- Laboratory findings:

  -Decreased serum sodium level below 135 mEq/L.

  -Decreased serum osmolality below 280 mOs/kg.

ACID BASE BALANCE AND IMBALANCE

- Chemical balance in the body is regulated by acidity or alkalinity, which is measured by a pH value.
- Acid base balance is regulated in the body by the ability to maintain the arterial pH between 7.35-7.45.
- ABG is the most effective way to evaluate acid base balance and oxygenation.
- Measurement of ABGs involve analysis of six components.

1)pH

2)Paco2+

3)Pao2+

4)Oxygen saturation

5)Base excess

6) Bicarbonate

TYPES OF ACID BASE IMBALANCES:

-acid base imbalances are either respiratory or metabolic depending on their underlying cause.

-The body corrects acid base imbalances through the process of compensation.

The four primary types of acid base imbalances are;

1)RESPIRATORY ACIDOSIS:

A) Hypoventilation resulting from primary respiratory problems.

Causes:

-Atelectasis(obstruction of small airways)

-pneumonia.

-cystic fibrosis.

-Airway obstruction.

-chest wall injury.

- Signs and symptoms:

  -Confusion

  -Dizziness.

  -Lethargy.

  -Headache.

  -Ventricular dysrhythmias.

  -Warm and flushed skin.

  -Muscular twitching.

  -Convulsion and

  -Coma.

- Laboratory findings:

  -Arterial Blood Gas analysis

  pH- below 7.35

  $Paco_2$- above 45mmHg

  Pao_2- below 80 mmHg

  Bicarbonate: normal if uncompensated or above 26mEq/L if compensated.

B) Hypoventilation resulting from factors outside of the respiratory system.

Causes:

-Drug overdose with a respiratory depressant

-Paralysis of respiratory muscles caused by various neurological attentions.

- Head injury.

-Obesity.

2)Respiratory alkalosis:

A)Hyperventilation Resulting from primary respiratory problems.

Causes:

-Asthma.

-Pneumonia.

-Inappropriate mechanical ventilator setting.

Signs and symptoms:

-Dizziness

-Confusion

-Dysrhythmias

-Tachypnea

-Numbness and tingling of extremities.

-Convulsion

-Coma.

Laboratory Findings:

-Arterial Blood Gas Alterations;

pH- above 7.45

Paco2- below 35 mmHg

Pao2- normal

Bicarbonate level- normal if uncompensated or below 22mEq/L if compensated.

B)Hyperventilation Resulting from factors outside of the respiratory system

Causes:-anxiety

-Hyper metabolic states (Fever, exercise)

- Disorders of Central nervous system.

-Salicylate overdose.

3) Metabolic acidosis:

A)High Anion gap: above 14 mEq/L.

Causes:

-Starvation.

-Diabetic ketoacidosis.

-Renal Failure.

-Lactic acidosis from Heavy exercise.

-Use of Drugs(Methanol, ethanol, aspirin)

Signs and symptoms:

- Headache

-Lethargy.

-Confusion.

-Dysrhythmias.

-Tachypnea.

-Abdominal cramps.

- Flushed skin.

- Laboratory findings:

  -Arterial blood Gas alterations:

  pH- below 7.35

  Paco2- normal

  Pao2- normal or increased (with rapid , deep respiration)

  Bicarbonate- below 22 mEq/L and O2 saturation normal

B)Normal Anion gap: 12 mEq/L

Causes:

-Renal tubular acidosis.

Diarrhoea.

4) Metabolic Alkalosis:

Causes:

-Excessive vomiting.

-Prolonged gastric suctioning.

-Hypokalaemia or hypercalcemia.

-Excess aldosterone.

-Use of Drugs (Steroids, sodium, Bicarbonate, Diuretics)

Signs and symptoms:

-Dizziness.

-Dysrhythmias.

-Numbness and tingling of fingers, toes, and mouth region.

-Muscle cramps and tetany.

Laboratory findings:

ABGs Alterations: pH - 7.45

Paco2- Normal

Pao2- normal

Bicarbonate- above 26 mEq/L

FACTORS AFFECTING BODY FLUIDS

- Developmental factors
- Environmental and lifestyle factors.
- Physiological factors.
- Clinical factors

MANAGEMENT

- HEALTH PROMOTION:
  - Advice active adults to supplement fluid loss from perspiration by increasing oral fluids.
  - Consume 6-8 glasses water daily.
  - Maintaining adequate environmental ventilation.
  - Avoid food with excess salt, sugar, caffeine.
  - Eat well balanced diet.
  - Limit alcohol intake.
  - Increase fluid intake before, during and after exercise.
  - Replace lost electrolytes.
  - Maintain normal body weight.
  - Refraining from excessive activity during times of excess environmental heat.
  - Learn about monitor, manage side effects of medication.
  - Recognize risk factors.
  - Seek professional health care for notable signs of fluid imbalance.

- Client with renal failure need to avoid excess intake of fluid, sodium potassium and phosphorus.
- A client with heart disease should learn to obtain the accurate body weight each day.

MEDICAL MANAGEMENT:

SODIUM

HYPERNATREMIA:

- Treat underlying causes.
- If oral fluids can not be ingested, IV solution of 5% dextrose in water or hypotonic saline(0.3% sodium chloride)
- Diuretics to treat the sodium gain.
- Serum sodium levels must be reduced gradually to avoid cerebral oedema.
- Desmopressin acetate, a synthetic ADH, may be prescribed to treat diabetes insipidus if it is the cause of hypernatremia.

- Nursing management:
  - Oral fluids.
  - Iv fluids/tube feedings.
  - Assess changes in sensorium, thirst, oral mucous membrane.
  - Assess vital signs.
  - maintain intake and output chart.
  - Maintain daily weight.
  - Oral care.
  - Monitor foods and medications for sodium content.
  - Assess changes in mental status.
  - Monitor serum sodium and urine specific gravity.
  - Provide psychological support.
- Nursing diagnosis:

  Risk for injury.

  Risk for sensory/ perception alteration.

  Risk for fluid deficit

  Risk for altered mucous membrane.

- HYPONATREMIA:
  - Cause water excess, fluid restriction needed.
  - Seizure can occur, small amount of intravenous hypertonic saline solution (3% nacl).
  - Associated with abnormal fluid loss, fluid replacement with sodium containing solution needed.
  - Common treatment is careful administration of odium by mouth, nasogastric tube or parenteral route.
  - For a patient who can eat and drink, sodium is easily replaced, for those who can not consume sodium , lactated Ringer's solution or isotonic saline (0.9% sodium chloride).
- Nursing management:
  - Safety measures.
  - Maintain intake and output chart.
  - Daily weight.
  - Assess for sources of sodium loss.
  - Monitor lab. For sodium and urine specific gravity.
  - Give food and fluids high in sodium.

- Assess for fluid overload; lung sound, respiratory status, oedema etc.
- Care with cardiovascular disease.
- Assess the mental status.
- Neurological examination; orientation, level of consciousness, seizure etc.

- **Nursing Diagnosis:**
- Risk for injury
- Risk for fluid volume excess
- Risk for sensory perception alterations.
- Risk for altered mucous membrane.
- Altered thought process.
- Risk for impaired skin integrity.

POTASSIUM:

- **HYPERKALEMIA:**
  - Eliminate oral and parenteral potassium intake.
  - Increase elimination of potassium by diuretics, dialysis.
  - Force potassium from ECF to ICF by insulin or sodium bicarbonate.
  - Reverse membrane effect of elevated ECF potassium by administering calcium gluconate IV.
  - Monitoring of blood pressure is essential to detect hypotension which may result from the IV Administration of calcium gluconate.
  - ECG should be continuously monitored during the administration the appearance of bradycardia is an indication to stop the infusion.
  - Beta-2 agonists, such as albuterol are highly effective in decreasing potassium; it moves potassium into the cells and may be used in the absence of ischemic cardiac disease.

- Nursing management:
  - Monitor signs and symptoms.
  - Do not use tourniquet long when drawing blood can cause false high potassium.
  - Monitor serum electrolytes.
  - Monitor ECG.
  - Assess renal function.
  - Monitor intake and output chart.
  - Use fresh blood for potassium investigation.
  - Monitor vital signs.
  - Monitor ABG.
- Nursing diagnosis:
  - Potential complication; dysrhythmias
  - Risk for injury.
  - Risk for decreased cardiac output.
  - Imbalanced nutrition.

- HYPOKALEMIA:
  - Replacement PO or IV;

    -never push IV.

    -painful in peripheral lines.

    -never give with an uric renal failure renal failure.

    -Potassium loss must be corrected daily; administration of 40-80 mEq/day of potassium is adequate in the adult if there are no abnormal losses of potassium.
  - For oral potassium diet containing potassium, intake of potassium in the adult is 50 -100 mEq/day, it includes fruits, vegetables, legumes, whole grains, milk and meat.
  - IV potassium supplements may be prescribed, many salt substitute contain 50-60 mEq of potassium per tea spoon.
  - KCL is usually used to correct potassium deficits, potassium acetate or potassium phosphate may be prescribed.
- Nursing management:
  - Intake and output chart possible hourly.
  - Daily weight.

- Urine output more than 20-30 cc/hr essential if give potassium supplements and IV fluids.
- Assess client on digoxin carefully for toxicity (digitalis).
- Monitor serum potassium level.
- Caution with salt substitutes if on potassium sparing diuretics.
- Assess for fatigue , anorexia , muscle weakness, decreased bowel mobility, paresthesias, and dysrhythmias.
- Monitor the ECG.
- Monitor vital signs.

- Nursing diagnosis:
- Potential complication; dysrhythmias.
- Risk for injury.
- Risk for ineffective breathing pattern
- Decreased cardiac output
- Constipation
- fatigue

- CALCIUM:

HYPERCALCEMIA:

- Loop diuretics
- Hydration with isotonic saline solution.
- Synthetic calcitonin.
- Mobilization
- Treating the underlying causes.
- Administering fluids to dilute serum calcium and promote its excretion by the kidneys, mobilizing the patient, and restricting dietary calcium intake.
- IV administration of 0.9% sodium chloride solution, dilute the calcium level and increase the urinary calcium excretion.
- Administering IV phosphate can cause a reciprocal drop in serum calcium.
- Calcitonin can be used to lower the serum calcium level and its particularly useful for heart disease.
- Inorganic phosphate salts can be administered orally or by nasogastric tube, rectally or IV phosphate therapy may be used

- Nursing management:
  - Monitor intake and output chart.
  - Assess renal function /renal stone; cardiac function.
  - Assess signs and symptoms.
  - Orientation to reality/ level of consciousness.
  - Oral/IV fluids.
  - Diet; decrease ca.
  - Safety.
  - Monitor signs and symptoms of digitalis toxicity.
  - Evaluate serum electrolytes.
  - Increase mobility.
  - Give loop diuretics and inorganic phosphate.
- Nursing diagnosis: Risk of injury
  - Risk for constipation
  - Knowledge deficit

- HYPOCALCEMIA:
  - Oral or IV calcium supplements
  - Treatment of pain and anxiety.
  - IV administration of calcium salt, calcium gluconate, and calcium chloride
  - Solutions containing phosphates or bicarbonate should also be used with calcium.
  - Vitamin D therapy for calcium absorption.
- Nursing management:
  - Assess signs and symptoms.
  - Quiet, calm environment.
  - Seizures precautions.
  - Maintain airway.
  - Educate about osteoporosis.
  - Avoid hyperventilation.
  - Monitor ECG.
  - Assess for heart failure.
  - Injury prevention strategies.

❑ MAGNESIUM:

➢ HYPERMAGNESEMIA:

- Avoid administration of magnesium to patient with renal failure.
- Ventilator support and IV calcium gluconate are indicated in emergencies,
- Haemodialysis with magnesium free dialysate.
- Administration of loop diuretics and sodium chloride or RL.

➢ NURSING MANAGEMENT:

- Assess the vital signs of the patient.
- Assess the signs and symptoms.
- Assess neuromuscular status of the patient.
- Safety measure
- Avoid magnesium in diet and medicine.
- NURSING DIAGNOSIS: Risk for injury.
- Risk for impaired gas exchange.
- Knowledge deficit.

- HYPOMAGNESEMIA:
  - Can be corrected by diet alone if mild.
  - Administered magnesium salts in an oxide or gluconate form.
  - Parenteral administration of magnesium.
  - Discontinue medication that promote magnesium loss.
  - If severe give magnesium sulphate with infusion pump not exceed 150mg/min .
- NURSING MANAGEMENT:
  - Assess the vital signs.
  - Monitor serum level.
  - Administer oral magnesium.
  - Nutritional therapy.
  - Monitor respiratory status.
  - Monitor ECG
- NURSING DIAGNOSIS: Risk for injury
- Imbalanced nutrition
- Knowledge deficit.

PHOSPHORUS:

HYPERPHOSPHATEMIA:

- Adequate hydration, restricting foods and fluids containing phosphorus.
- IV administration of calcitriol.
- Volume replacement with saline and dialysis.
- Surgery may be indicated for removal of large calcium phosphorus deposit.

NURSING MANAGEMENT:

- Assess tetany .
- Assess vital signs.
- Limit vitamin D.
- Monitor serum level.
- Observe for calcification.
- Monitor intake/output, BUN, Creatinine level.
- Avoid phosphate containing enema and laxatives.

HYPOPHOSPHATEMIA:

- Adequate amount of phosphorus should be added to parenteral solutions and also oral.
- High phosphorus diet.
- IV administration of sodium or potassium phosphate.

NURSING MANAGEMENT:

- Monitor vital signs.
- Assess the signs and symptoms.
- Monitor lab values.
- Nutrition therapy .
- Monitor ECG.

NURSING DIAGNOSIS:

- Impaired physical mobility.
- Impaired gas exchange.
- Risk for fall.
- Risk for decreased cardiac output.

CHLORIDE:

HYPERCHLOREMIA:

- Hypotonic IV solution.
- Administered RL.
- IV sodium bicarbonate.
- Administered diuretics.
- Sodium, chloride and fluids are restricted.

NURSING MANAGEMENT:

- Assess the vital signs.
- Monitor lab values.
- Assess the vital signs.
- Maintain intake and output chart.
- Monitor ABG levels.
- Monitor respiratory and cardiac status.

HYPOCHLOREMIA:

- Correct underlying causes.
- Replace other electrolytes.
- Replace oral if not too law and able to tolerate.
- IV NS or 0.45% sodium chloride.
- Discontinue loop, osmotic and thiazide diuretics.
- Ammonium chloride, an acidifying agent prescribed to treat metabolic alkalosis.

NURSING MANAGEMENT:

- Assess the vital signs.
- Assess the signs and symptoms.
- Maintain intake and output chart.
- Monitor ABG and electrolytes level.
- Monitor respiratory and cardiac status.
- Assess level of consciousness.
- Provide oral supplements.