King Saud University

College of Nursing

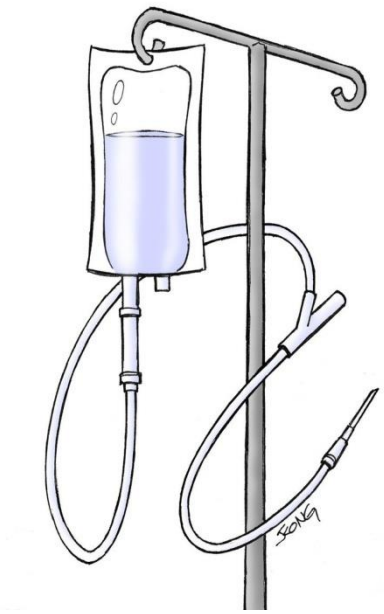
Medical Surgical Department

Application of Adult Health Nursing Skills

(NUR 317)

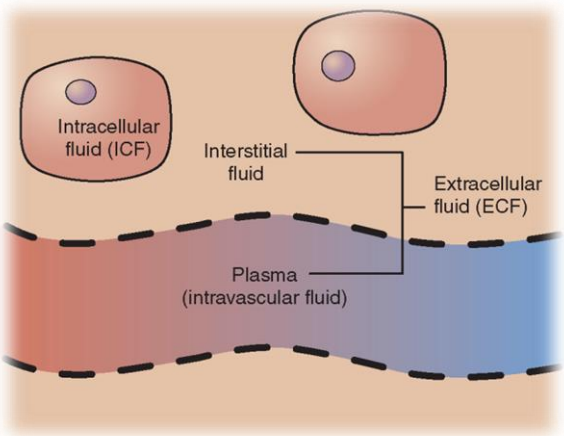
Care for patients with fluid and electrolytes imbalance

- **Outline of lecture;**
  - ✓ Introduction
  - ✓ Fluid and electrolytes balance
  - ✓ Fluid and electrolytes imbalance
  - ✓ Assessment of Edema, Dehydration
  - ✓ Measuring intake and output
  - ✓ IVF (intravenous fluids)



Care for patients with fluid and electrolytes imbalance

Normal anatomy and physiology



Water comprises 60% of the body weight of an average adult, the total body water is divided functionally into the extracellular (ECF = 20% of body weight) and the intracellular fluid spaces (ICF = 40% of body weight) separated by the cell membrane.

The ECF is further divided into the intravascular (within the circulation) and the interstitial (extravascular fluid surrounding the cells) fluid space.

Fluid Functions:

- Help regulate body temperature
- Transport nutrients and gases throughout the body
- Carry cellular waste products to excretion sites

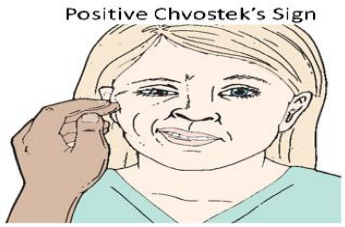
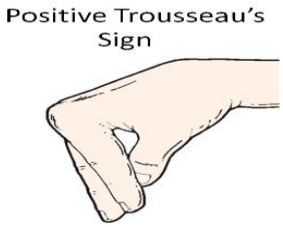
Electrolytes :

Electrolytes are a major component of body fluids that play important roles in maintaining chemical balance, there are six major electrolytes; sodium, potassium,calcium, chloride, phosphorus, and magnesium.

Major Intracellular Electrolytes	Functions
Potassium (K+)	• Regulates cell excitability & nerve impulse conduction • Permeates cell membranes, thereby affecting the cell's electrical status (resting membrane potential) • Regulates muscle contraction and myocardial membrane responsiveness
Magnesium (Mg+)	• Modifies nerve impulse transmission and skeletal muscle response • Important in the functioning of the heart, nerves, and muscles • Influences normal function of the cardiovascular system and Na+ and K+ ion transportation
Phosphorus/Phosphate (P-)	• Promotes energy storage and carbohydrate, protein and fat metabolism
Major Extracellular Electrolytes	**Functions**
Sodium (Na+)	• Helps maintain acid base balance • Activates nerve and muscle cells • Influences water distribution (with chloride)
Calcium (Ca+)	• Found in cell membranes it helps cells adhere to one another and maintain their shape • Acts as an enzyme activator within cells (muscles must have Ca+ to contract) • Aids in coagulation • promotes nerve impulse and muscle contraction/relaxation

Sodium (Na) Normal rang: 135-145 mEq/L	
Causes of elevation (Hypernatremia)	**Causes of decline (Hyponatremia)**
Water loss, inadequate water intake, excessive sodium intake, Diabetes Insipidus (DI), certain diuretics, corticosteroid use, antihypertensive drug.	Inadequate sodium intake, Excessive water gain caused by inappropriate administration of I.V. solutions, heart and renal failure, cirrhosis, laxatives, nasogastric suctioning, Medications such as antidiabetics, diuretics.
Signs/Symptoms	**Signs/Symptoms**
✓ Thirst, dry sticky mucous membranes; ✓ Restlessness, disorientation, ✓ Muscle weakness and irritability	✓ Confusion Orthostatic hypotension ✓ Nausea, vomiting ✓ Weight gain, Edema ✓ Muscle spasms, convulsions
Nursing Intervention	**Nursing Intervention**
✓ Identify patients at risk for hypernatremia. ✓ Assess the patient for fluid losses. ✓ Assess the patient for signs and symptoms ofhypernatremia. ✓ Consult with a nutritionist to determine ✓ Encourage the patient to increase his fluidintake but decrease his sodium intake. ✓ Teach the patient and his family how to prevent,recognize, and treat hypernatremia	✓ Identify patients at risk for hyponatremia. ✓ Assess fluid intake and output. ✓ Assess the patient for signs and symptoms ofhyponatremia. ✓ Restrict fluid intake. ✓ Administerisotonic I.V. fluids. ✓ that ensure appropriate fluid and sodium intake.

Potassium (K) Normal Level 3.5 - 5 mEq/L	
Causes of elevation (Hyperkalemia)	**Causes of decline (Hypokalemia)**
High potassium intake related to the improper use of oral supplements, excessive use of salt substitutes, or rapid infusion of potassium solutions.	GI losses from diarrhea, laxative abuse, prolonged gastric suctioning, prolonged vomiting.
Signs/Symptoms	**Signs/Symptoms**
✓ arrhythmias, ✓ decreased strength of contraction,and cardiac arrest ✓ Nausea, vomiting, diarrhea, ✓ intestinal colic, uremic enteritis, ✓ decreased bowel sounds, abdominal distention.	✓ fatigue, muscle weakness ✓ orthostatic hypotension ✓ cardiac arrest ✓ Suppressed insulin release and aldosterone secretion ✓ Respiratory muscle weakness slightly elevated glucose level
Nursing Intervention	**Nursing Intervention**
✓ Identify patients at risk for hyperkalemia. ✓ Assess for signs and symptoms of hyperkalemia. ✓ Have emergency equipment available. ✓ Administer calcium gluconate to decrease myocardial irritability. ✓ Administer insulin and I.V. glucose to move potassium back into cells. ✓ Carefully monitor serum glucose levels. ✓ Administer sodium polystyrene sulfonate (Kayexalate) with 70% sorbitol to exchange sodium ions for potassium ions in the intestine	✓ Identify patients at risk for hypokalemia. ✓ Assess the patient's diet for a lack of potassium. ✓ Assess the patient for signs and symptoms of hypokalemia. ✓ Administer a potassium replacement asprescribed. ✓ Encourage intake of high-potassium foods,such as bananas, dried fruit, and orange juice. ✓ Monitor the patient for complications. ✓ Have emergency equipment available for cardiopulmonary resuscitation and cardiac defibrillation.

Calcium Normal Level 4.5 – 5.5 mEq/L	
Causes of elevation (hypercalcemia)	**Causes of decline (hypocalcemia)**
Metastatic bone cancer, hyperparathyroidism,High calcium intake, Hyperthyroidism or hypothyroidism	acute pancreatitis, inadequate dietary intake of vitamin D, longterm use of laxatives, thyroid carcinoma, loop diuretics.
Signs/Symptoms	**Signs/Symptoms**
✓ Muscle weakness and lack of coordination ✓ Anorexia, constipation, abdominal pain, nausea, vomiting, peptic ulcers, and abdominal distention ✓ Confusion, impaired memory,slurred speech, and coma ✓ Cardiac arrest	✓ Tingling around the mouth and in the fingertips and feet, numbness, ✓ painful muscle spasms. ✓ Positive Chvostek's signs or Positive trousseau's sings ✓ Seizures ✓ confusion, and hallucinations ✓ Skeletal fractures resulting from osteoporosis  
Nursing Intervention	**Nursing Intervention**
✓ Assess the patient for signs and symptoms of hypercalcemia. ✓ Encourage ambulation. ✓ Move the patient carefully to prevent fractures. ✓ Administer phosphate to inhibit GI absorption of calcium. ✓ Administer a loop diuretic to promote ✓ calcium excretion. ✓ Reduce dietary calcium.	✓ Assess the patient for signs and symptoms of hypocalcemia, especially changes in cardiovascular and neurologic status and in vital signs. ✓ Administer I.V. calcium as prescribed. ✓ Administer a phosphate-binding antacid. ✓ Take seizure or emergency precautions as needed. ✓ Encourage the patient to increase his intake of foods that are rich in calcium and vitamin D.
Magnesium (Mg) Normal level 1.5 - 2.5 mEq/L	
Causes of elevation (*Hypermagnesemia*)	**Causes of decline (*Hypomagnesemia*)**
Renal failure, adrenal insufficiency, or diuretic abuse Excessive magnesium replacement or excessive use of milk of magnesia .	malnutrition, malabsorption anorexia, intestinal bypass for obesity, diarrhea, diuretics or antibiotics, such as gentamicin, Overdose of vitamin D or calcium, burns, pancreatitis, or diabetic ketoacidosis
Signs/Symptoms	**Signs/Symptoms**
✓ Peripheral vasodilation with decreased blood pressure, ✓ Facial flushing and sensations of warmth and thirst ✓ Lethargy or drowsiness, apnea, and coma ✓ Loss of deep tendon reflexes, paresis. ✓ Cardiac arrest	✓ Muscle weakness, tremors, Seizure . ✓ Decreased blood pressure, ventricular ✓ fibrillation, tachyarrhythmias, ✓ depression, agitation, confusion, and hallucinations ✓ Nausea, vomiting, and anorexia ✓ Decreased calcium level
Nursing Intervention	**Nursing Intervention**
✓ Review all medications for a patient with renal failure. ✓ Assess the patient for signs and symptoms of ✓ hypermagnesemia. ✓ Assess reflexes; if absent, notify the practitioner. ✓ Administer calcium gluconate.	✓ Assess the patient for signs and symptoms of hypomagnesemia. ✓ Administer I.V. magnesium as prescribed. ✓ Encourage the patient to consume magnesium-rich foods.

✓ Prepare the patient for hemodialysis if prescribed. ✓ If the patient is taking an antacid, a laxative, or another drug that contains magnesium, instruct him to stop. ✓ Teach the patient and his family how to prevent, recognize, and treat hypermagnesemia	✓ If the patient is confused or agitated, take safety precautions. ✓ Take seizure precautions as needed. ✓ Teach the patient and his family how to prevent, recognize, and treat hypomagnesemia
Phosphorus (p) Normal level 2.5 - 4.5 mg/dl	
Causes of elevation (*Hyperphosphatemia*)	**Causes of decline (*Hypophosphatemia*)**
Renal disease, Hypoparathyroidism or hyperthyroidism, Excessive vitamin D intake, Muscle necrosis, excessive phosphate intake, or chemotherapy	Glucose administration or insulin release, respiratory alkalosis, Malabsorption syndromes, diarrhea, vomiting, aldosteronism, diuretic therapy.
Signs/Symptoms	**Signs/Symptoms**
✓ Soft-tissue calcification (chronic hyperphosphatemia) ✓ Hypocalcemia, possible with tetany ✓ Increased red blood cell count	✓ Irritability, confusion, decreased level of consciousness, ✓ seizures, and coma ✓ Weakness, numbness, and paresthesia ✓ Respiratory muscle weakness ✓ elevated creatine kinase level, ✓ hyperglycemia, and metabolic acidosis
Nursing Intervention	**Nursing Intervention**
✓ Assess the patient for signs and symptoms of hyperphosphatemia and hypocalcemia, including ✓ tetany and muscle twitching. ✓ Advise the patient to avoid foods and medications that contain phosphorus. ✓ Administer phosphorus-binding antacids. ✓ Prepare the patient for possible dialysis.	✓ Assess the patient for signs and symptoms of hypo-phosphatemia, especially neurologic. ✓ Administer phosphate supplements as prescribed. ✓ Note calcium and phosphorus levels because calcium and phosphorus have an inverse relationship.

Fluid and electrolyte imbalances

Fluid and electrolyte balance is essential for health. Many factors, such as illness, injury, surgery, and treatments, can disrupt a patient's fluid and electrolyte balance. Even a patient with a minor illness is at risk for fluid and electrolyte imbalance.

Fluid Volume Deficit (Hypovolemia)	**Fluid Volume Excess (Hypervolemia)**
The body loses water all the time. A person responds to the thirst reflex by drinking fluids and eating foods that contain water. However, if water isn't adequately replaced, the body's cells can lose water. This causes dehydration, or fluid volume deficit. Dehydration refers to a fluid loss of 1% or more of body weight	Hypervolemia refers to an excess of fluid (water and sodium) in ECF. The body has compensatory mechanisms to deal with hypervolemia. However, if these fail, signs and symptoms develop.
Etiology/Cause • Hemorrhage • Vomiting • Diarrhea • Burns • Diuretic therapy • Fever • Impaired thirst	**Etiology/Cause** • Congestive Heart Failure • Early renal failure • IV therapy • Excessive sodium ingestion • Corticosteroid

Fluid Volume Deficit (Hypovolemia)	Fluid Volume Excess (Hypervolemia)
Signs/Symptoms; **Mild Fluid Loss:** • Orthostatic hypotension, Increased heart rate • Restlessness, anxiety • Weight loss **Moderate Fluid Loss:** • Confusion, dizziness, irritability • Extreme thirst • Nausea -Cool, clammy skin • Rapid Pulse • Decreased urine output (10-30 ml/hr) **Severe Fluid Loss:** • Decreased cardiac output • Unconsciousness • Hypotension • Weak or absent peripheral pulses •	**Signs/Symptoms;** • Tachypnea ,Dyspnea, crackles • Rapid or bounding pulse • Hypertension (unless in heart failure) • Distended neck and hand veins • Acute weight gain • Edema • Pulmonary edema - Dyspnea -Orthopnea (diff. breathing when supine) -crackles

Assessing fluid balance

There are three elements to assessing fluid balance and hydration status:

- Review of fluid balance charts;
- Clinical assessment;
- Review of blood chemistry.

Name: Date:

	Intake			Output			
Time	Intravenous fluid	Peg/parenteral nutrition	Oral intake	Vomit/gastric aspirate	Urine	Drains	Stoma
			cum. total				cum. total
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
TOTAL							

Total intake = ... Total output = ...

1- Review of fluid balance charts;

Fluid balance means the amount of fluid intake equal the amount of fluid excreted .

- **Intake include;** water, juice, tea and coffe, IV fluid , NG feeding
- **Output include;** urine, emesis, NG drainage, and blood drainage.

✓ Record all fluid intake in the sheet and calculate the total at the end of each shift
✓ Record all fluid output remember if patients on urine catheter each shift empty urine from catheter.
✓ IF Intake (I) more than Output (O) look for signs of edema
✓ IF Intake (I) less than Output (O) look for signs of dehydration

2- Nursing assessment for dehydration

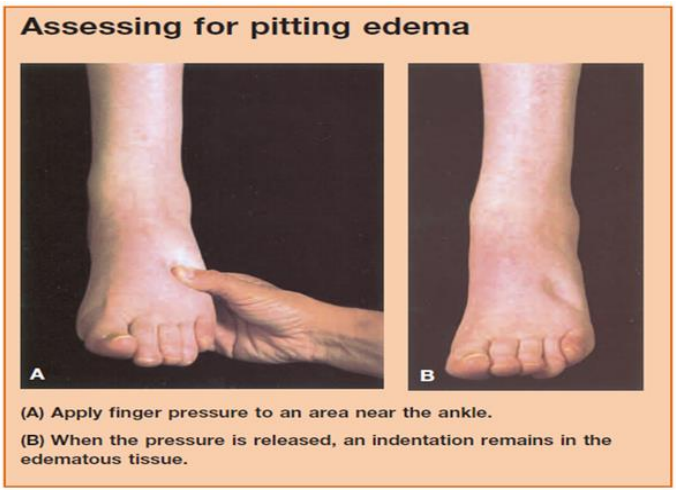
✓ Observations Vital signs, such as pulse, blood pressure and respiratory rate, will change when a patient becomes dehydrated

✓ Skin elasticity The elasticity of skin, or turgor, is an indicator of fluid status in most patients. However, this assessment can be an unreliable indicator of dehydration in older people as skin elasticity reduces with age

Lift the skin on the back of her hand with two fingers, then let go.

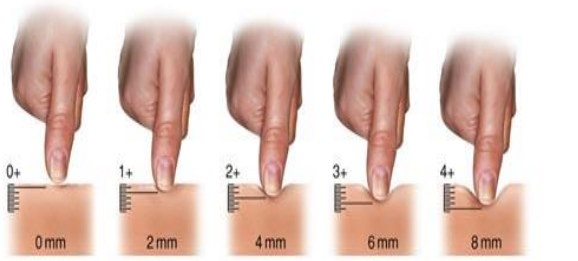
If the skin does not fall right back to normal, the woman is dehydrated.

2- Nursing assessment for edema



(A) Apply finger pressure to an area near the ankle.

(B) When the pressure is released, an indentation remains in the edematous tissue.

	 0+ No pitting edema 1+ Mild pitting edema. 2 mm depression that disappears rapidly. 2+ Moderate pitting edema. 4 mm depression that disappears in 10–15 seconds. 3+ Moderately severe pitting edema. 6 mm depression that may last more than 1 minute. 4+ Severe pitting edema. 8 mm depression that can last more than 2 minutes.
Medical treatment ✓ Treatment involves determining the cause (such as diarrhea or decreased fluid intake) and replacing lost fluids either orally or I.V. ✓ Most patients receive hypotonic, low sodium fluids such as dextrose 5% in water (D5W).	**Medical treatment** ✓ Treatment involves determining the cause and treating the underlying condition. ✓ Typically, patients require fluid and sodium restrictions ✓ Diuretics therapy may be ordered if renal failure is not the cause.

I.V. fluid replacement

The doctor may order I.V. fluid to maintain or restore fluid balance. I.V. fluid replacement fall into the broad categories of crystalloids and colloids;

A. **Colloids** - contain larger insoluble molecules (blood, albumin, plasma) used to increase the blood volume following severe loss of blood (haemorrhage) or loss of plasma (severe burns).

B. **Crystalloids –** contains aqueous solutions of mineral salts or other water-soluble molecules (salts and sugar.) to correct body fluids and electrolyte deficit

- **Isotonic**

A solution that has the same salt concentration as the normal cells of the body and the blood.

Examples:

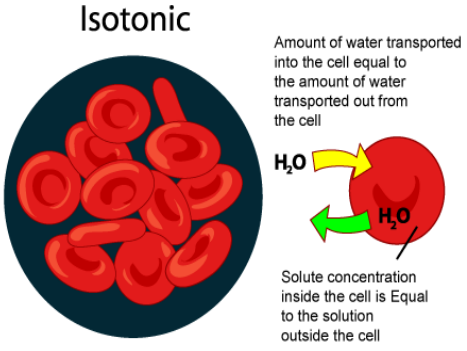
- ✓ Ringer Lactate .
- ✓ 0.9% NaCl (0.9% NSS)
- ✓ D5W.
- ✓ Normal saline
- ✓ same tonicity as body

Indication:

- ✓ Hypotension (increases BP),
- ✓ Hypovolemia

Complications of Isotonic

- ✓ IV fluid overload



▶ Hypertonic

A solution with a higher salts concentration than in normal cells of the body and the blood.

Examples :

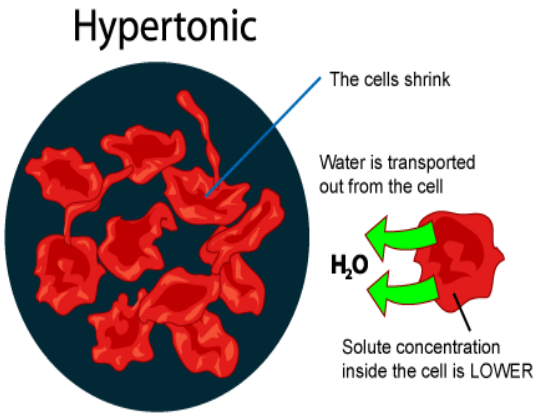
- ✓ D5W in normal Saline solution ,
- ✓ D5W in half normal Saline
- ✓ D10W.
- ✓ 5% normal saline
- ✓ D5 Ringers Lactate

Indication:

- ✓ low BP slight edema but not w/CHF

Complications ;

- ✓ circulatory overload.



▶ Hypotonic

A solution with a lower salts concentration than in normal cells of the body and the blood.

Examples :

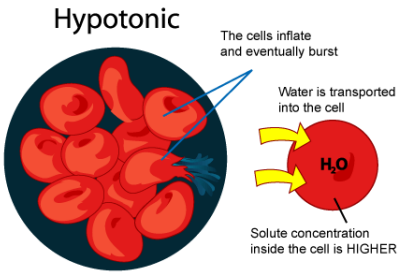
- ✓ 0.45% NaCl .
- ✓ 0.33% NaCl .
- ✓ 45% sodium chloride
- ✓ 5%dextrose water (becomes hypotonic in body)

Indication:

- ✓ Dehydration

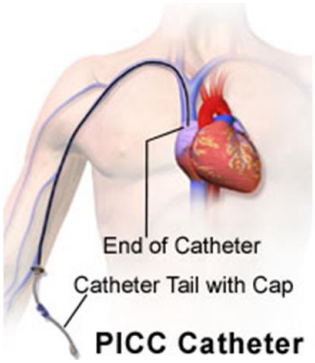
Complications ;

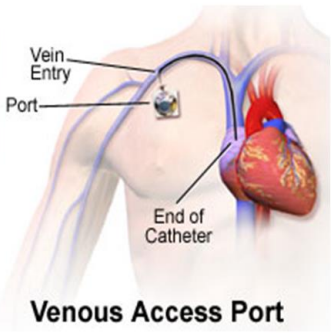
- ✓ May cause edema



Types of IV lines;

1. **Peripheral (hands)**
2. **Central Venous Catheter (big veins)**
   - PICC (Peripherally inserted Central Catheter)
   - CVC (Central venous catheter)





Advantages of IVI

- Immediate effect
- Patient cannot tolerate drugs / fluids orally
- Some drugs cannot be absorbed by any other route
- Pain and irritation is avoided compared to some substances when given SC/IM

Disadvantages/Complications of IVI

- Phlebitis; is inflammation of a vein

- Thrombophlebitis;
  is an irritation of the vein along with the formation of a clot; it's usually more painful than phlebitis. Look for pain, redness, swelling, or a red line streaking along the vein

- Infiltration; fluid may leak from the vein into surrounding Tissue, If you see infiltration, stop the infusion, elevate the extremity, and apply warm soaks.

- Infection ; Adhering to aseptic technique is vital in the prevention of intravenous related infections. Swab the site for culture and remove the catheter as ordered.

- Anaphylaxis/ Allergic reactions (Itching, rash, shortness of breath)

What the Nurse should do?

- STOP INFUSION and treat as indicated by Pharmacy, Medication package insert or drug reference book.
- Notify MD and document