MEDICAL CHEMISTRY
GENERAL CHEMISTRY

University Of Fallujah

College Of Medicine

Lecture : Medical Chemistry (6) (Dialysis & IV Fluid)

Stage : 1st Stage

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Department: Chemistry and Biochemistry department

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Learning Objective :

- Define dialysis and its importance in managing kidney failure.
- Differentiate between the types of dialysis, with a focus on hemodialysis.
- Describe the process of hemodialysis, including its components.
- Understand the role of IV fluids in dialysis.

DIALYSIS & IV FLUID

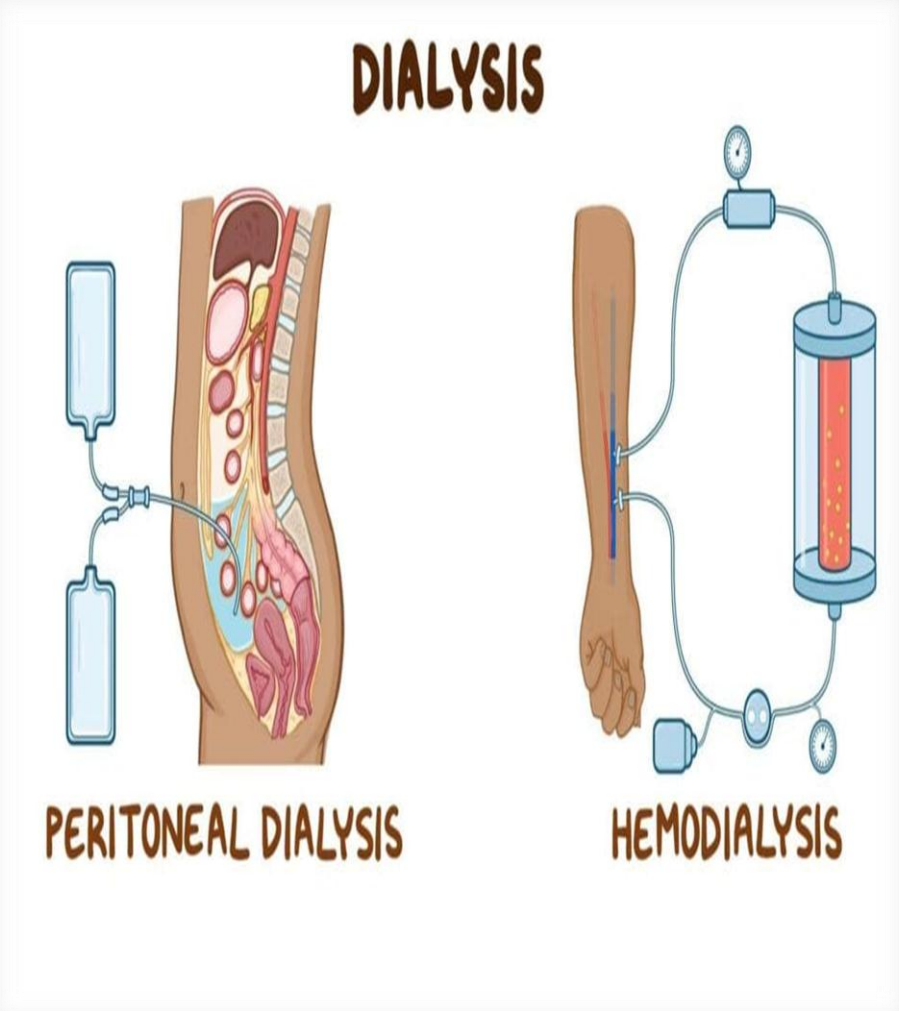
- **Introduction :**
- Definition of Dialysis :- A procedure that artificially removes waste, toxins, and excess fluid from the blood. **Or** A medical procedure to remove waste products and excess fluids from the blood when kidneys fail.

- Purpose: To replace kidney function in patients with kidney failure.
- - When Is It Needed?
- Acute Kidney Injury (AKI)
- Chronic Kidney Disease (CKD)

DIALYSIS & IV FLUID

- **Types of Dialysis :-**

1. **Hemodialysis (HD):**
   - Blood is filtered outside the body using a dialyzer.
   - Typically performed 3-4 times per week.
2. **Peritoneal Dialysis (PD):**
   - Uses the peritoneum as a filter.
   - Can be done at home (CAPD/APD).
3. **Continuous Renal Replacement Therapy (CRRT):**
   - Slow and continuous, used in critical care.



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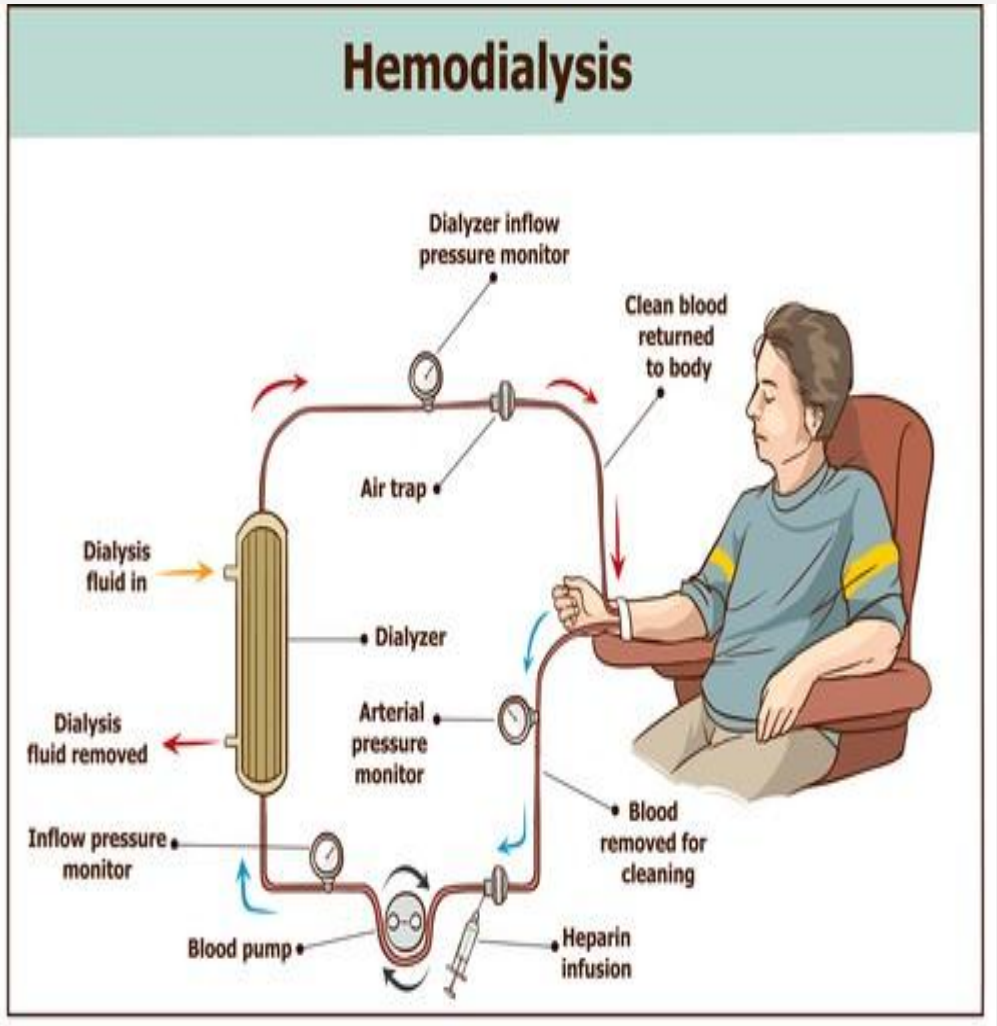
Hemodialysis: Blood is filtered through a machine.

*Components :

- Access Types:
  - Fistula: A surgical connection between an artery and vein.
  - Graft: A synthetic tube connecting an artery and vein.
  - Central Venous Catheter: Used for temporary access.
- Dialyzer: The artificial kidney that filters waste and toxins.
- Dialysate: A specialized fluid used to remove waste.



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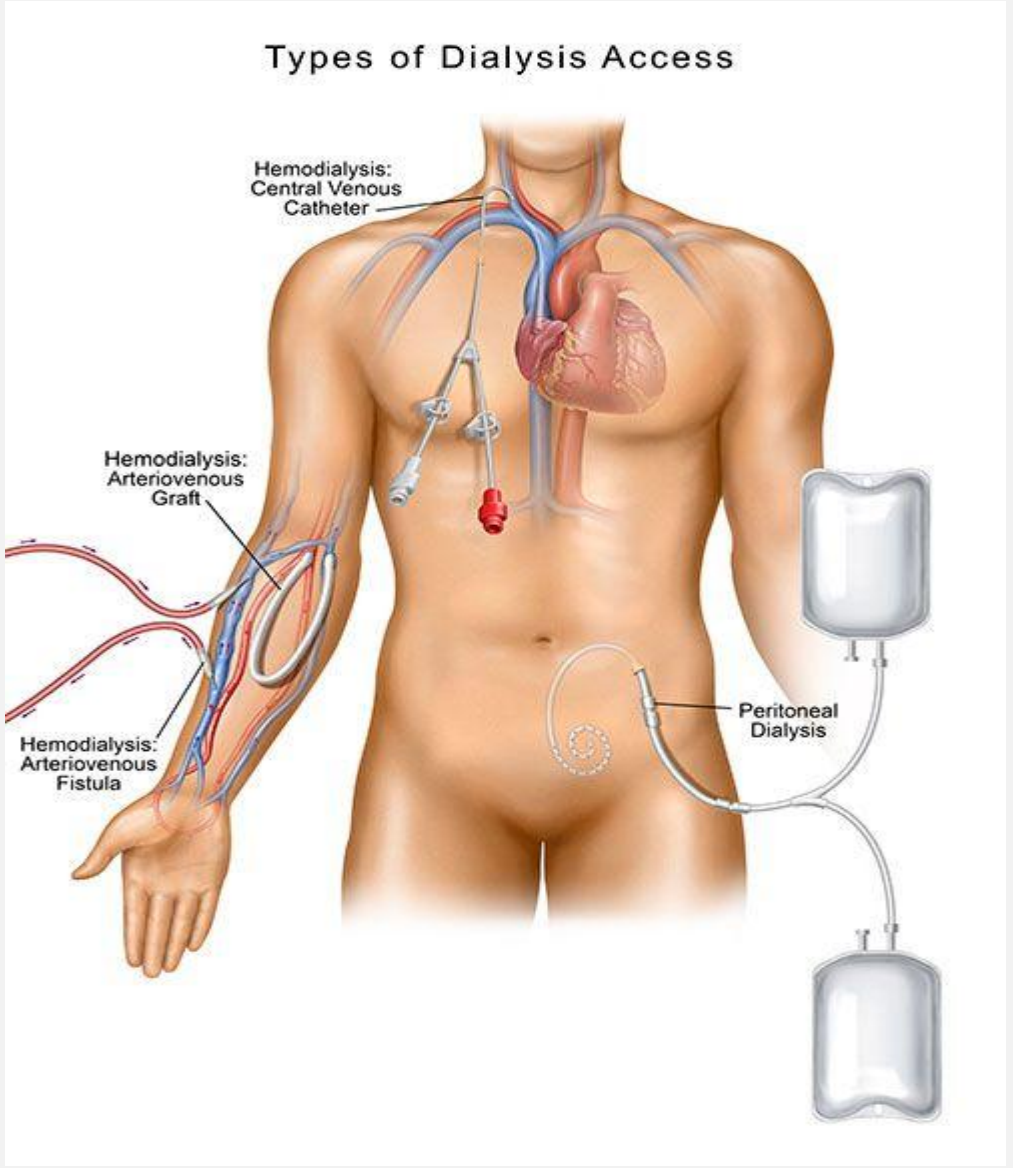
- **Hemodialysis: How It Works ? :**

1. Blood is drawn from the access site.
2. Blood flows into the dialyzer where:
   - Waste and toxins are filtered out.
   - Electrolyte balance is maintained.
   - Excess fluid is removed.
3. Clean blood is returned to the patient.



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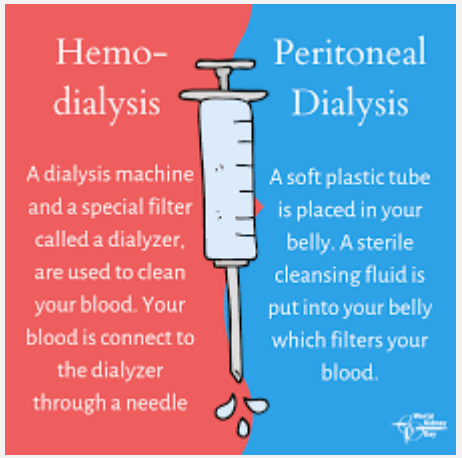
- **Advantages and Disadvantages of Hemodialysis :**



Advantages:

- More controlled and precise waste removal.
- Shorter procedure duration.

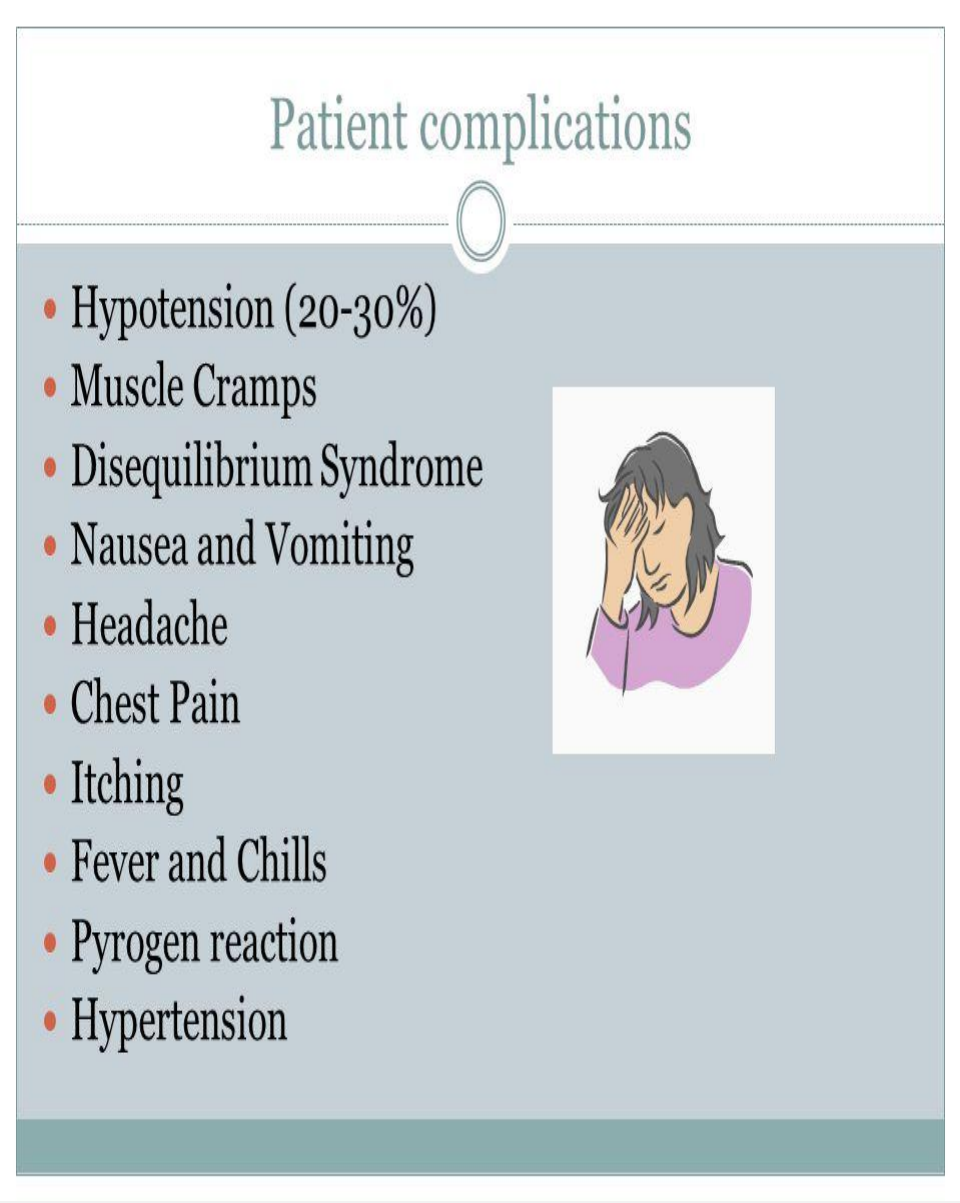
Disadvantages:

- Requires access points (fistulas, grafts).
- Risk of infection, hypotension, and long-term vascular issues.

DIALYSIS & IV FLUID

- **Complications of Hemodialysis:**

- Short-Term:
  - Hypotension.
  - Muscle cramps.
  - Nausea and vomiting.
- Long-Term:
  - Vascular access complications (e.g., thrombosis, infection).
  - Bone disease due to mineral imbalances.



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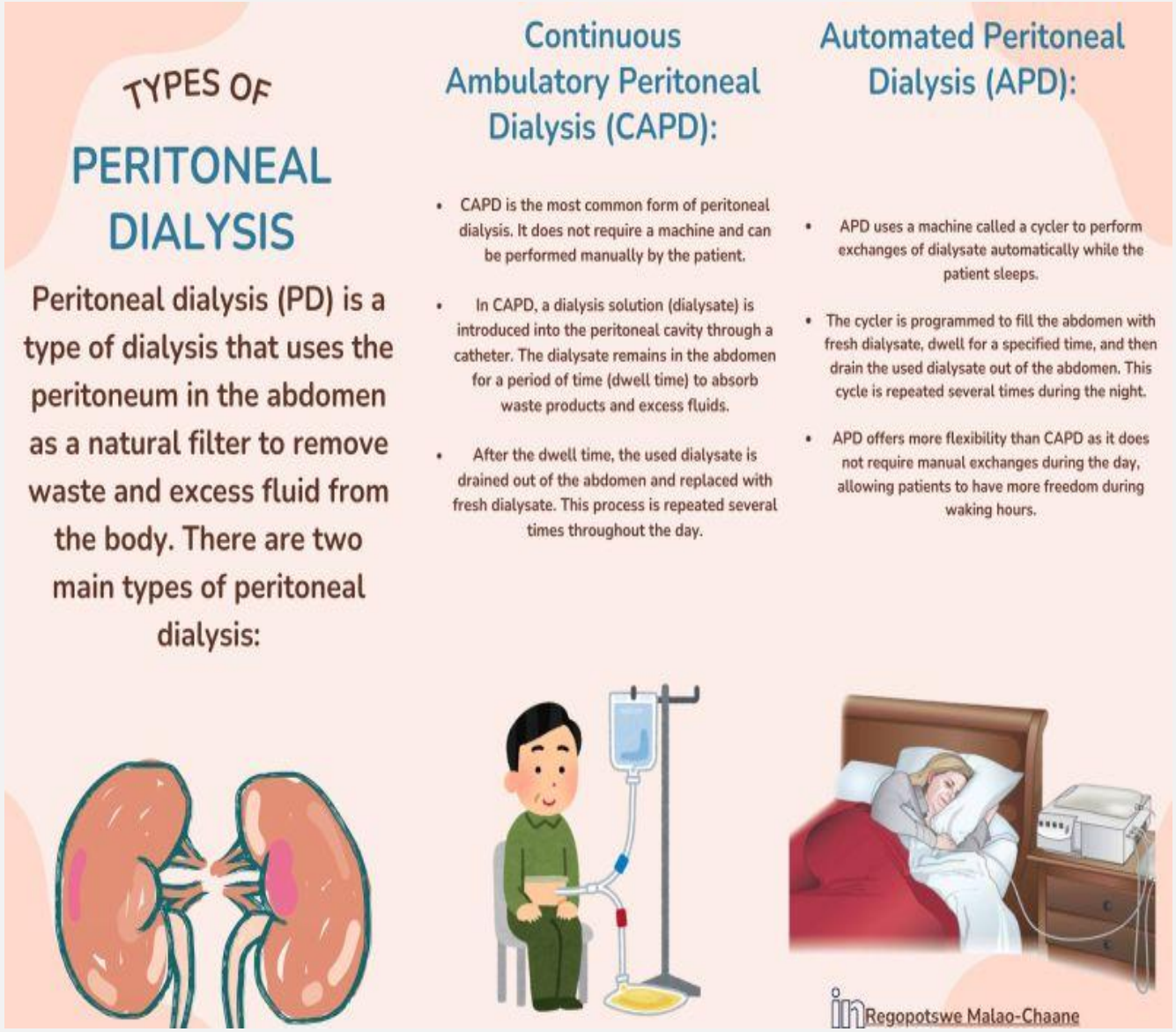
- **Peritoneal Dialysis:(Uses the peritoneum as a natural filter)**
- **How It Works? :**

1. Dialysis fluid is introduced into the abdominal cavity through a catheter.
2. The peritoneum acts as a natural filter, removing waste and fluid.
3. After a set period, the fluid is drained and replaced.

- Types:
  - Continuous Ambulatory Peritoneal Dialysis (CAPD).
  - Automated Peritoneal Dialysis (APD).



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- ## Advantages and Disadvantages of Peritoneal Dialysis :

Advantages:

- No need for dialysis machines or external equipment.
- Greater patient flexibility and independence.

Disadvantages:

- Risk of peritonitis.
- Requires more self-management and training.

DIALYSIS & IV FLUID

- **Complications of Peritoneal Dialysis:**

- Short-Term:

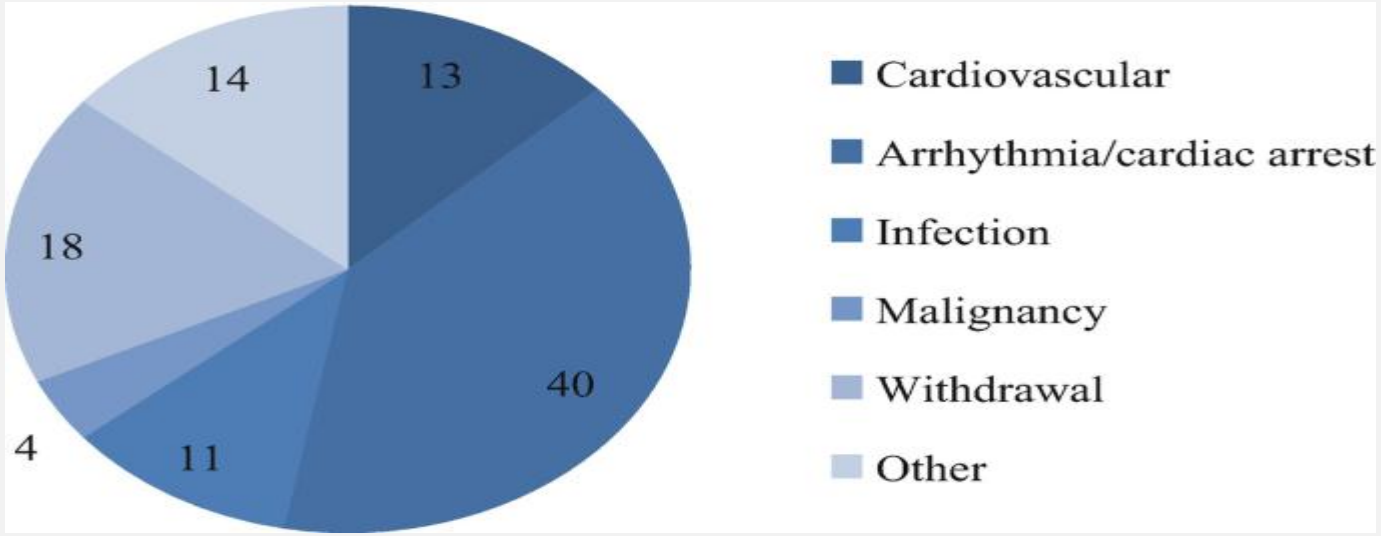
- Infection (e.g., peritonitis).

- Hernia due to abdominal pressure.

- Long-Term:

- Catheter-related complications.

- Reduced peritoneal membrane function over time.



DIALYSIS & IV FLUID

- **Introduction :**
- Definition of IV Fluids :- Sterile fluids infused directly into a vein to restore or maintain fluid balance . **OR IV fluids** are liquids injected into a person's veins through an IV (intravenous) tube. They prevent or treat dehydration and electrolyte imbalances.
- - Common IV Fluids Used :

- Crystalloids: Solutions containing small molecules that can pass through membranes like (Normal saline (0.9% NaCl), Ringer's Lactate, Dextrose). (used for fluid resuscitation) .

- Colloids : Solutions containing larger molecules that do not pass through membranes like (Albumin, Dextran. (Contain larger molecules like albumin for volume expansion and maintaining pressure) .

- Uses in Dialysis :
- - Correct fluid imbalances.
- - Manage hypotension during dialysis.

DIALYSIS & IV FLUID

Crystalloids: Definition and Types :

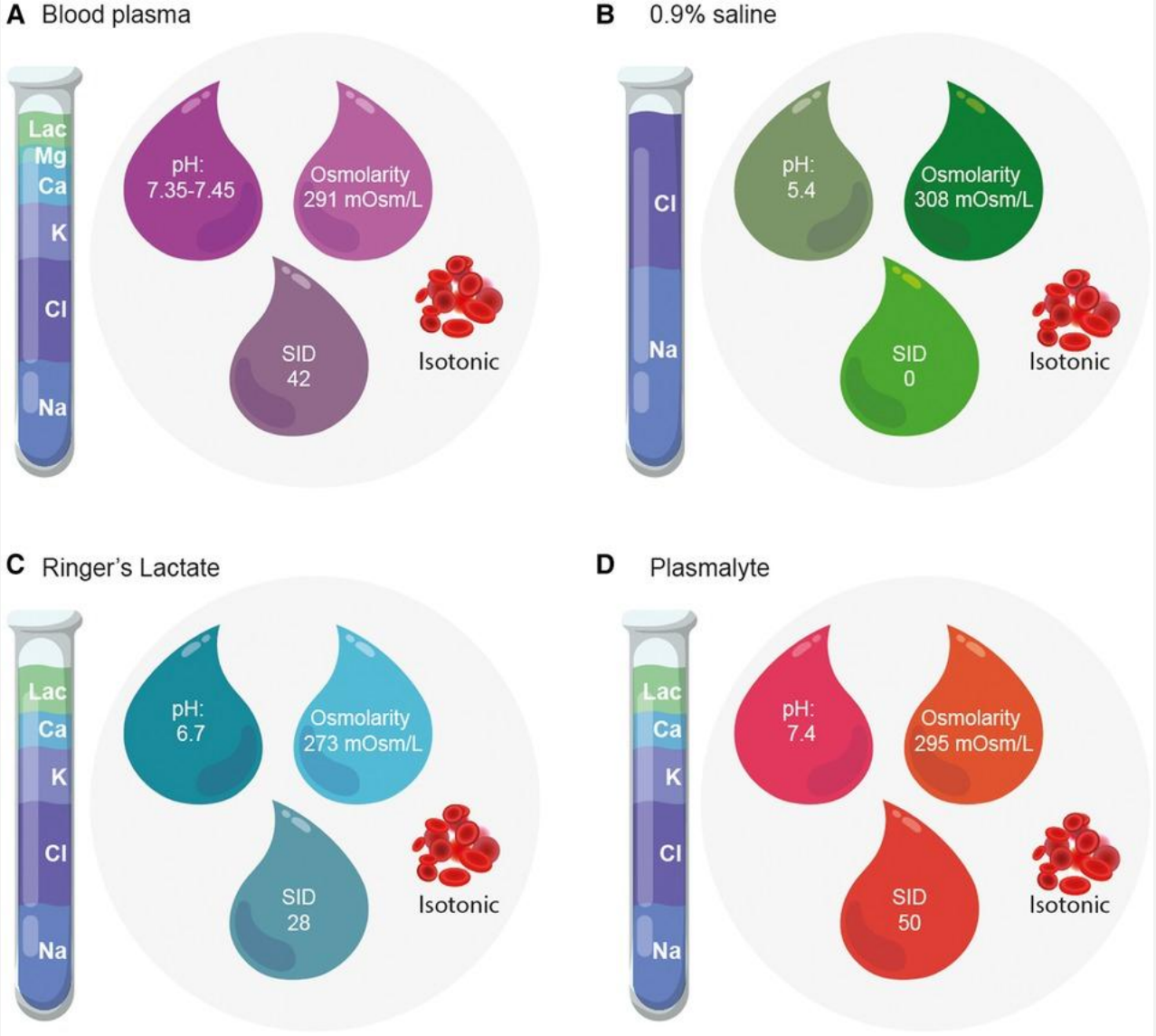
- Crystalloids: Solutions made of water and dissolved salts, sugars, or electrolytes.

- Common Types :

1. Normal Saline (0.9% NaCl): Used for fluid resuscitation and as a diluent for medications.

2. Ringer's Lactate: Contains sodium, potassium, calcium, and lactate; used in surgery or trauma for fluid replacement.

3. Dextrose Solutions (D5W): Contains glucose, used for hydration and energy provision.



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Colloids : Definition and Types :

- **Colloids:** Solutions with larger molecules, like proteins or starches, which remain in the bloodstream and draw fluid into the circulatory system.

- Common Types :

1. Albumin: A protein solution used to treat hypoalbuminemia and shock.

2. Dextran: A synthetic colloid used for volume expansion.

3. Hespan (Hetastarch): A synthetic starch solution used in critical care for volume resuscitation.

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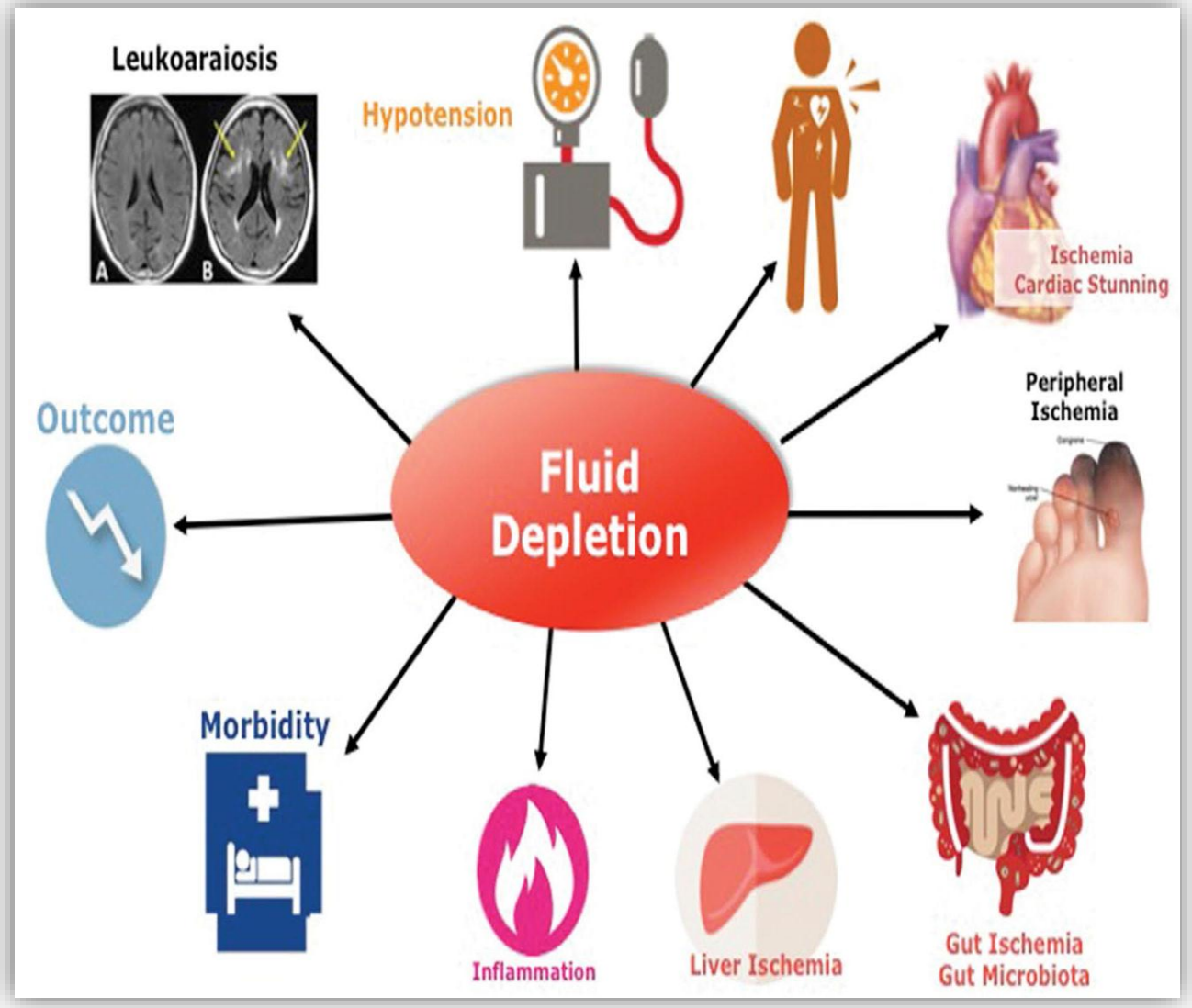
Role of IV Fluids in Dialysis :

- Pre-Dialysis:
  - To stabilize blood pressure.
  - Address dehydration.
- During Dialysis:
  - Manage hypotension or cramps.
  - Ensure vascular access patency.
- Post-Dialysis:
  - Replace any excess fluid loss.



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Role of IV Fluids in Fluid Management During Dialysis :

- Why IV Fluids Are Important ?

1- Correcting hypotension during dialysis.

2- Managing electrolyte imbalances.

3- Maintaining vascular volume.

A- Hypotonic IV Fluids : Fluids that have a lower concentration of solutes than the blood plasma. **Example:** 0.45% Normal Saline (Half Normal Saline). **Uses:** a-Treating dehydration by replenishing intracellular fluid. b-Can cause cell swelling if used excessively. **Caution:** Not used in patients with low blood pressure or risk of cerebral edema.

B- Hypertonic IV Fluids : Fluids that have a higher concentration of solutes than the blood plasma. **Example:** 3% NaCl (Hypertonic Saline), D10W (Dextrose 10% in water). **Uses:** Used to treat conditions like hyponatremia (low sodium) or to reduce brain swelling (cerebral edema). **Caution:** Requires careful monitoring to avoid dehydration and electrolyte imbalances.

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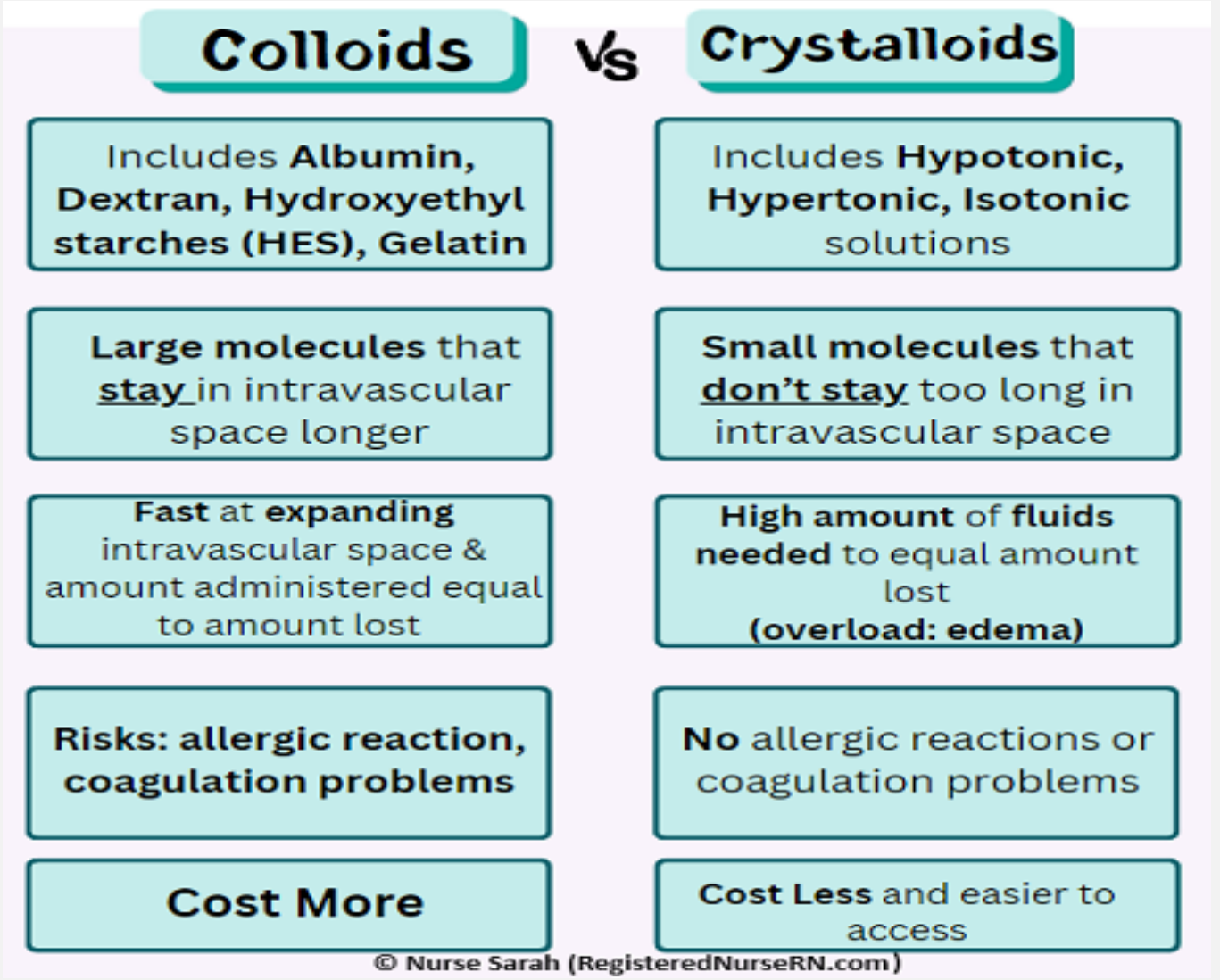

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The Importance of IV Fluids in Medical Care:

1. Are sick (vomiting and diarrhea).
2. Exercise too much or spend too much time in the heat without drinking enough.
3. Have a serious injury or burns.
4. Have surgery, especially when you're asleep for a long time or are unable to eat or drink.

DIALYSIS & IV FLUID

Indications for Dialysis:

- Kidney Failure:

  - Acute (e.g., after trauma or toxin exposure).

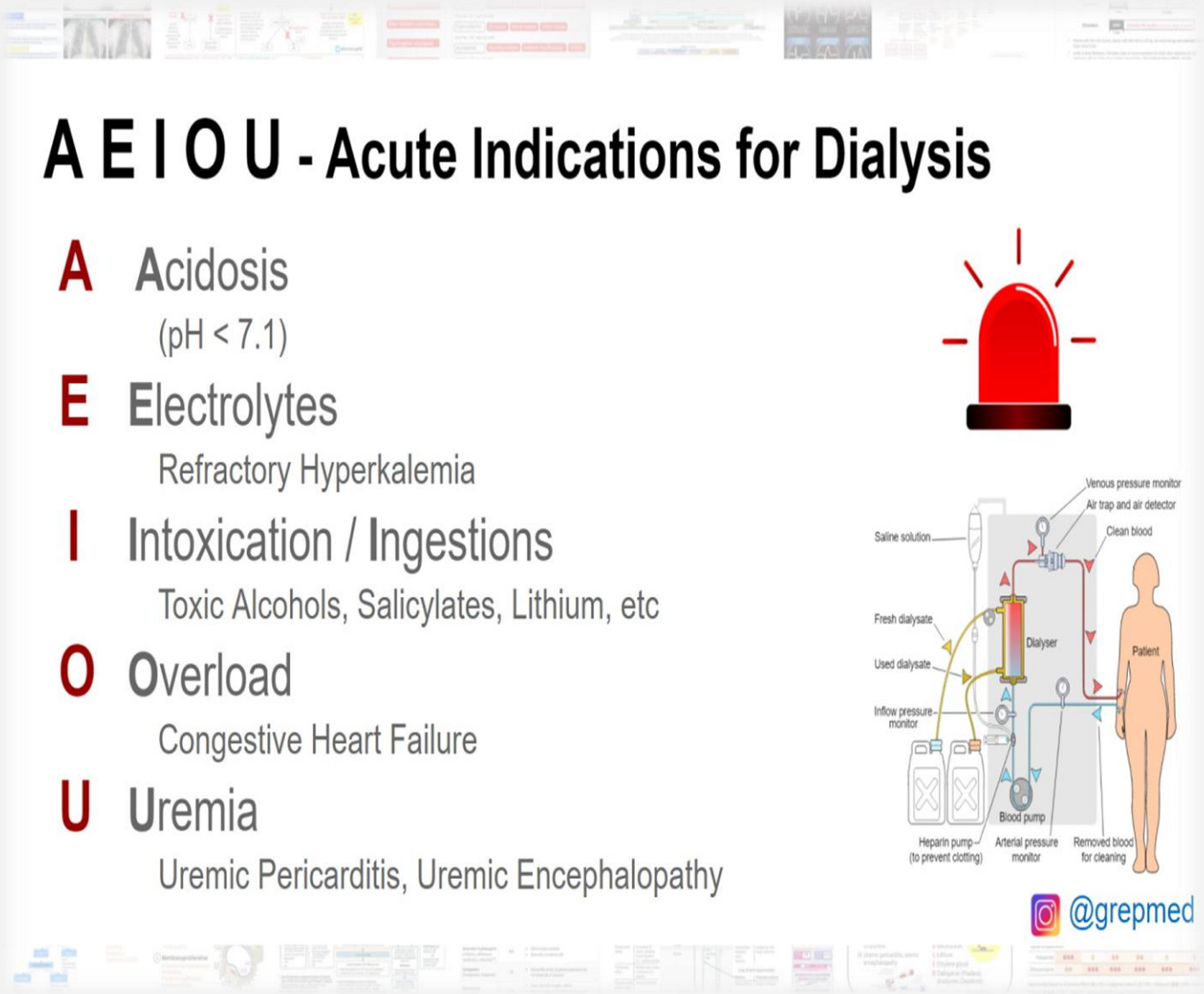
  - Chronic (e.g., from diabetes, hypertension).

- Specific Symptoms:

  - Severe uremia (nausea, confusion).

  - Fluid overload leading to pulmonary edema.

  - Life-threatening electrolyte imbalances, e.g., hyperkalemia.



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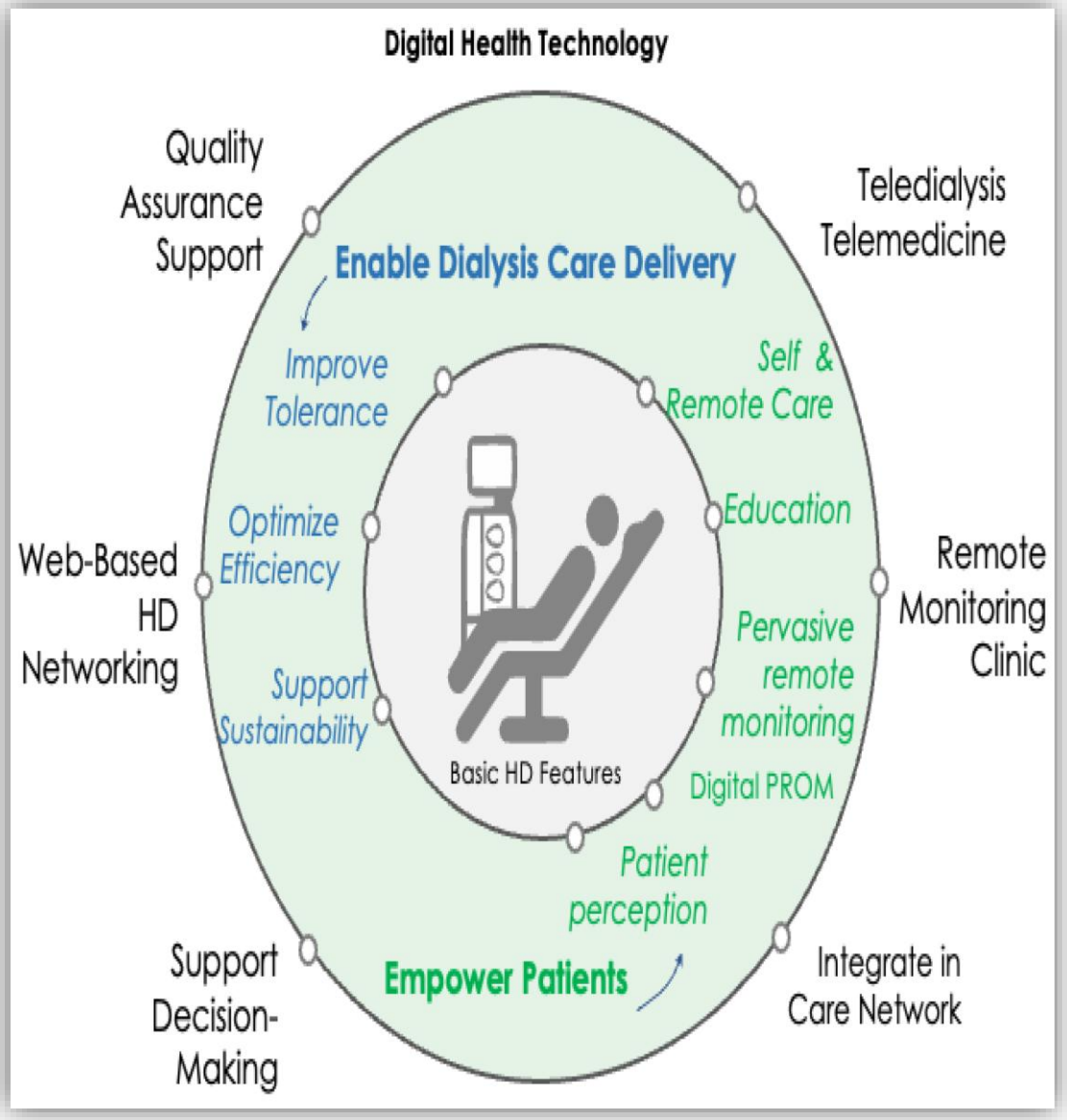
The Importance of Dialysis Duration:

Treatment Frequency :

- Typically 3-4 times per week.
- Duration: Usually 3-5 hours per session.
- Factors Influencing Duration:
- Dialysis adequacy, patient's condition, and access type.




THANK YOU
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