



MEDICAL CHEMISTRY GENERAL CHEMISTRY

University Of Fallujah
College Of Medicine

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

Stage : 1st Stage

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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):

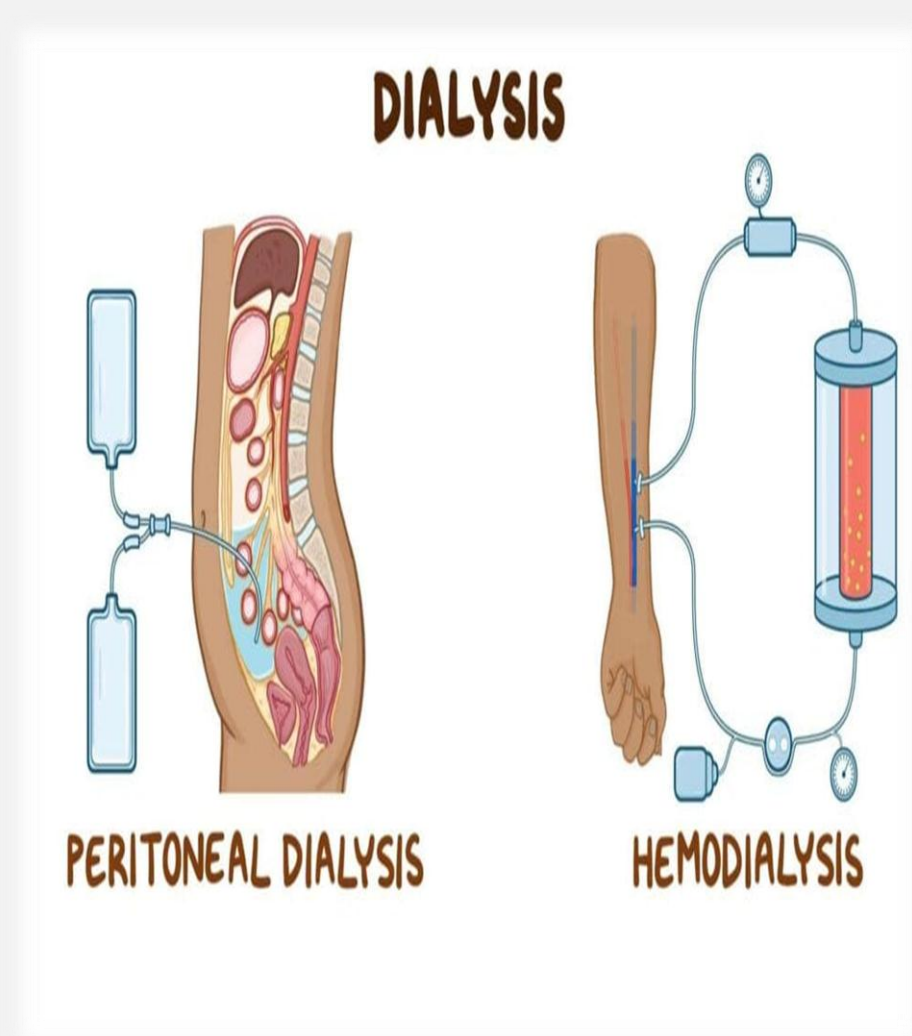
- Blood is filtered outside the body using a dialyzer.
- Typically performed 3-4 times per week.

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.



DIALYSIS & IV FLUID

Hemodialysis: Blood is filtered through a machine.

***Components :**

- **Access Types:**

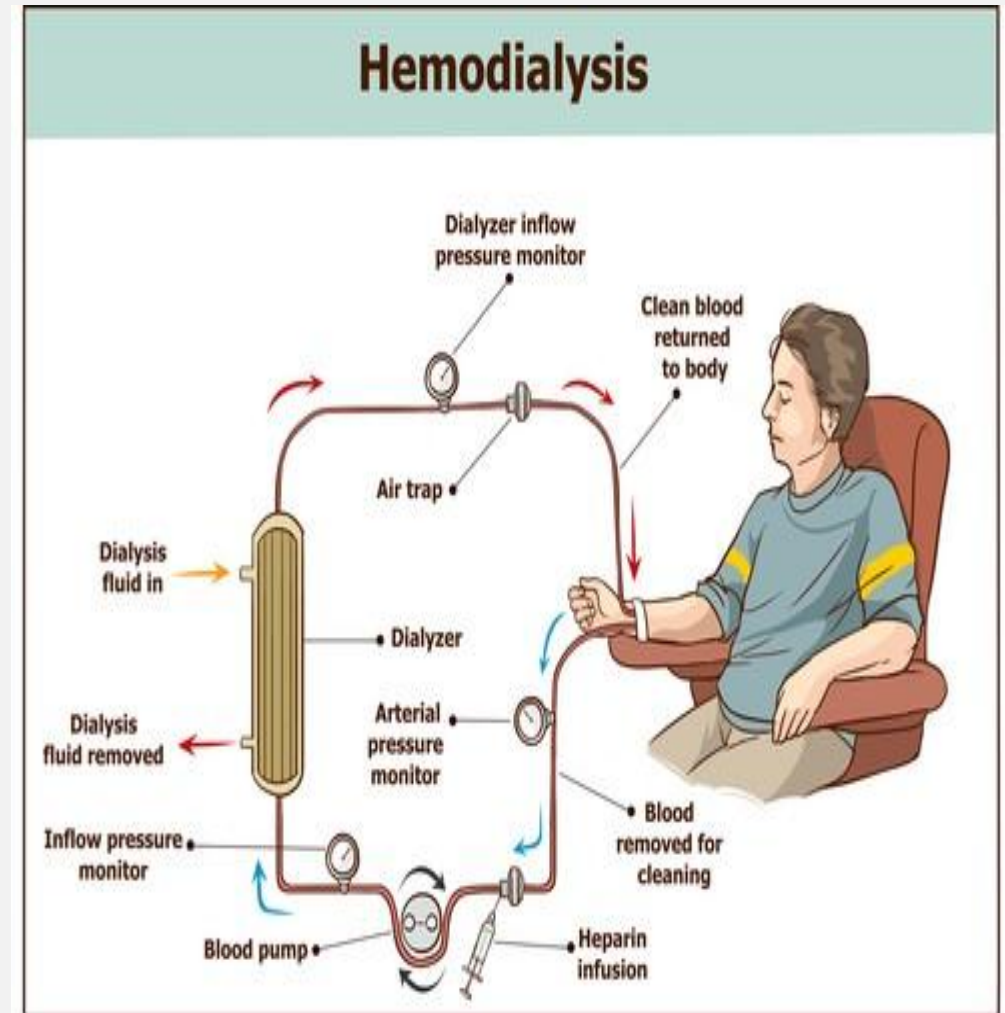
- **Fistula:** A surgical connection between an artery and vein.

- **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.

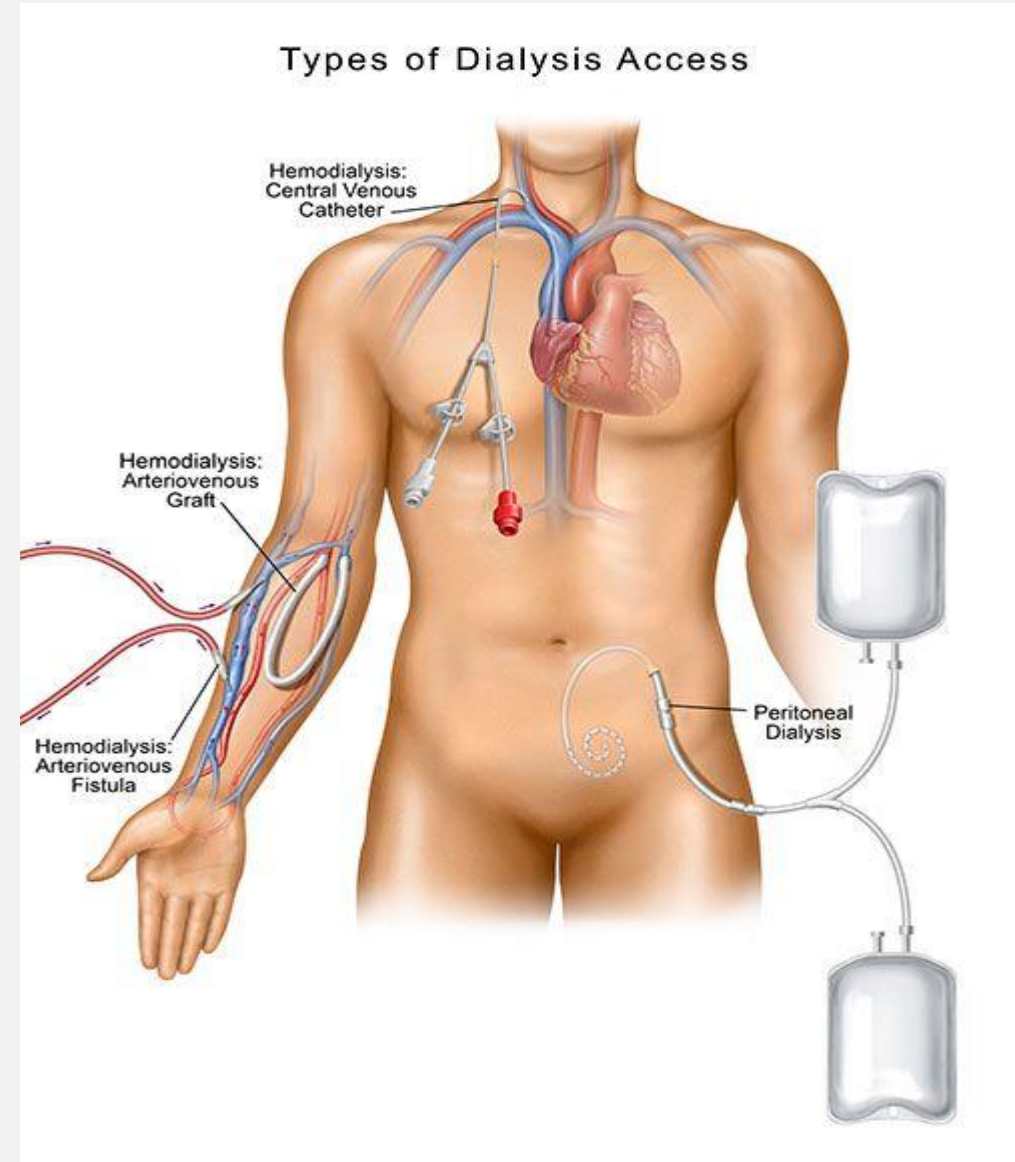
- **Dialysate:** A specialized fluid used to remove waste.



DIALYSIS & IV FLUID

• 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.



DIALYSIS & IV FLUID

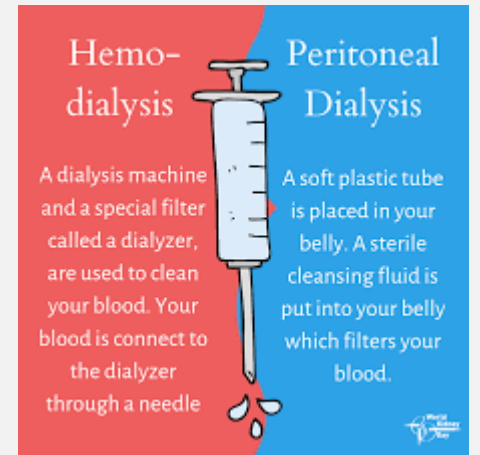
• Advantages and Disadvantages of Hemodialysis :

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.



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• 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.

Patient complications

- Hypotension (20-30%)
- Muscle Cramps
- Disequilibrium Syndrome
- Nausea and Vomiting
- Headache
- Chest Pain
- Itching
- Fever and Chills
- Pyrogen reaction
- Hypertension



DIALYSIS & IV FLUID

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

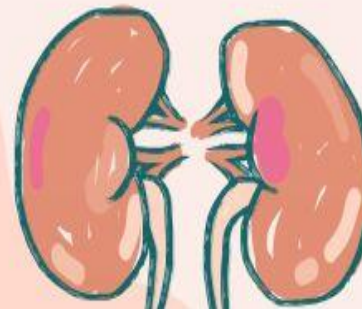
1. Dialysis fluid is introduced into the abdominal cavity through a catheter.
2. The peritoneum acts as a natural filter, removing waste and fluid.
3. After a set period, the fluid is drained and replaced.

- Types:

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

TYPES OF PERITONEAL DIALYSIS

Peritoneal dialysis (PD) is a type of dialysis that uses the peritoneum in the abdomen as a natural filter to remove waste and excess fluid from the body. There are two main types of peritoneal dialysis:



Continuous Ambulatory Peritoneal Dialysis (CAPD):

- CAPD is the most common form of peritoneal dialysis. It does not require a machine and can be performed manually by the patient.
- In CAPD, a dialysis solution (dialysate) is introduced into the peritoneal cavity through a catheter. The dialysate remains in the abdomen for a period of time (dwell time) to absorb waste products and excess fluids.
- After the dwell time, the used dialysate is drained out of the abdomen and replaced with fresh dialysate. This process is repeated several times throughout the day.



Automated Peritoneal Dialysis (APD):

- APD uses a machine called a cycler to perform exchanges of dialysate automatically while the patient sleeps.
- The cycler is programmed to fill the abdomen with fresh dialysate, dwell for a specified time, and then drain the used dialysate out of the abdomen. This cycle is repeated several times during the night.
- APD offers more flexibility than CAPD as it does not require manual exchanges during the day, allowing patients to have more freedom during waking hours.



DIALYSIS & IV FLUID

• 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.



Continuous Ambulatory
Peritoneal Dialysis



Automated
Peritoneal Dialysis

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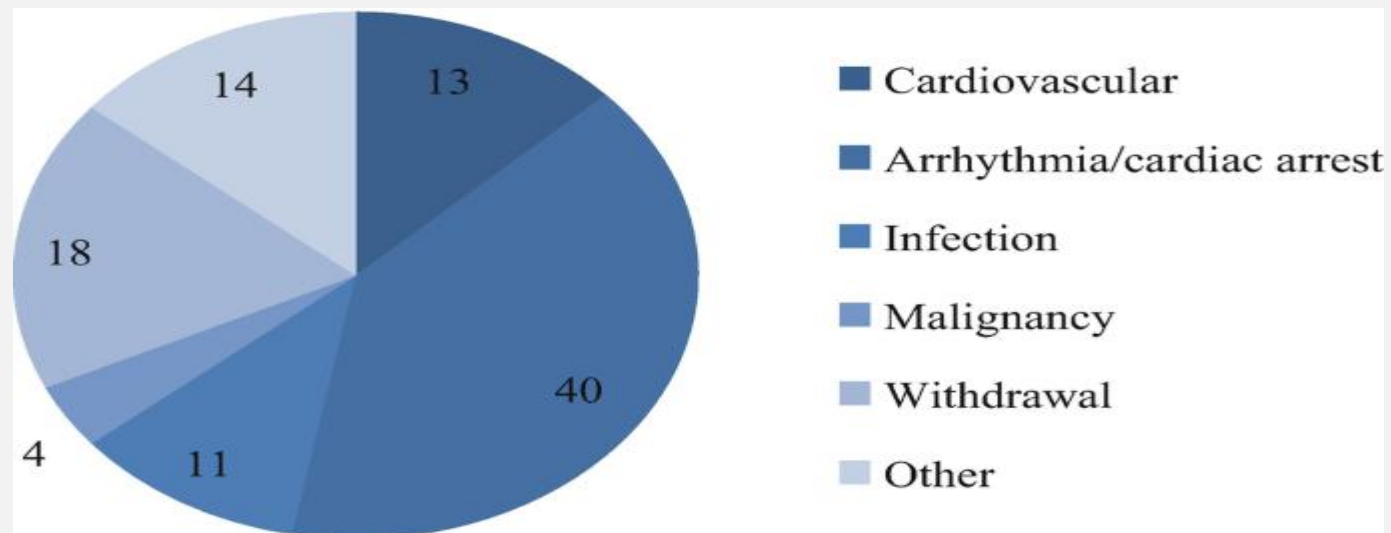
- Complications of Peritoneal Dialysis:

- 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 :

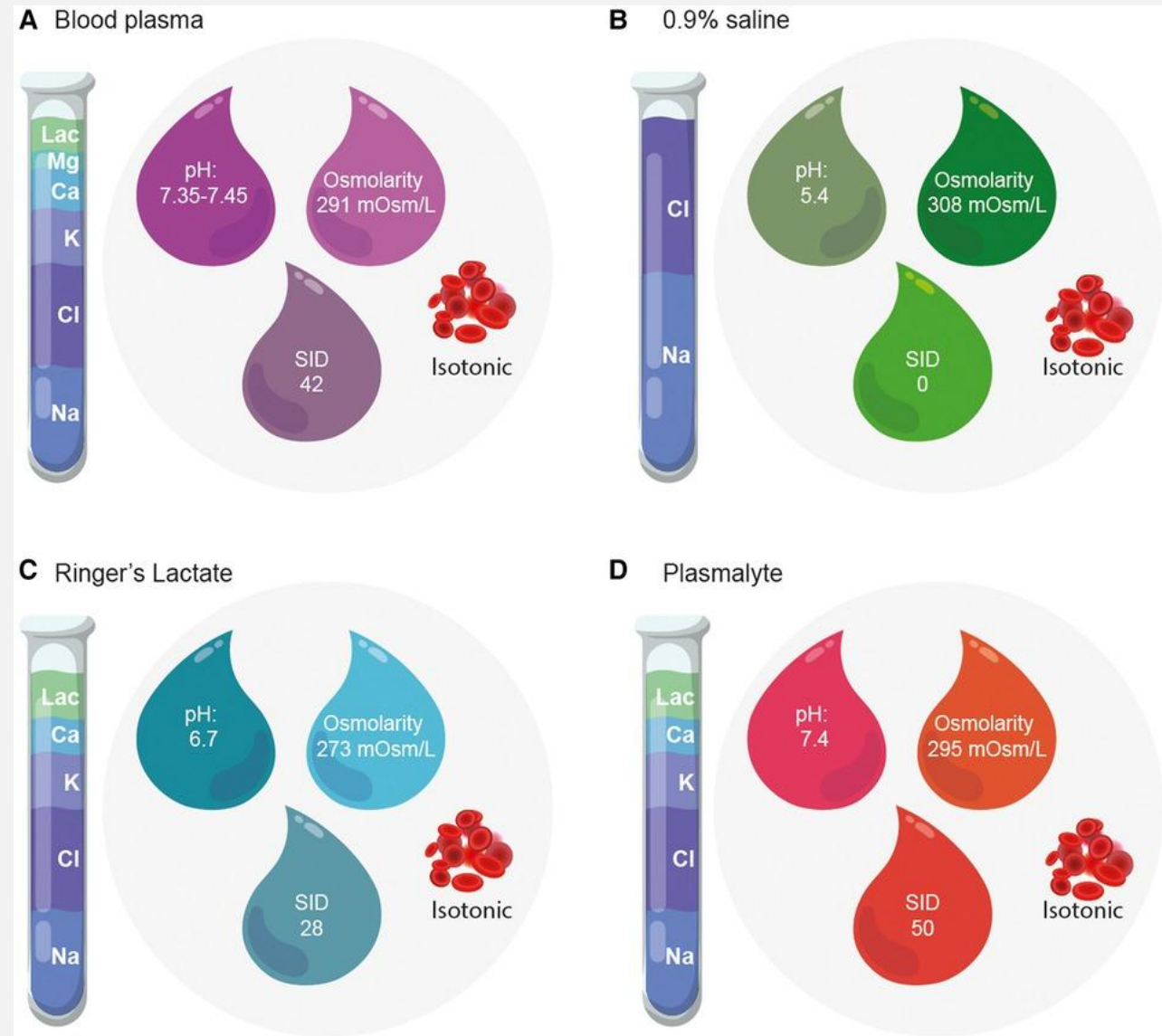
- Crystalloids: Solutions made of water and dissolved salts, sugars, or electrolytes.

- 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.



DIALYSIS & IV FLUID

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:

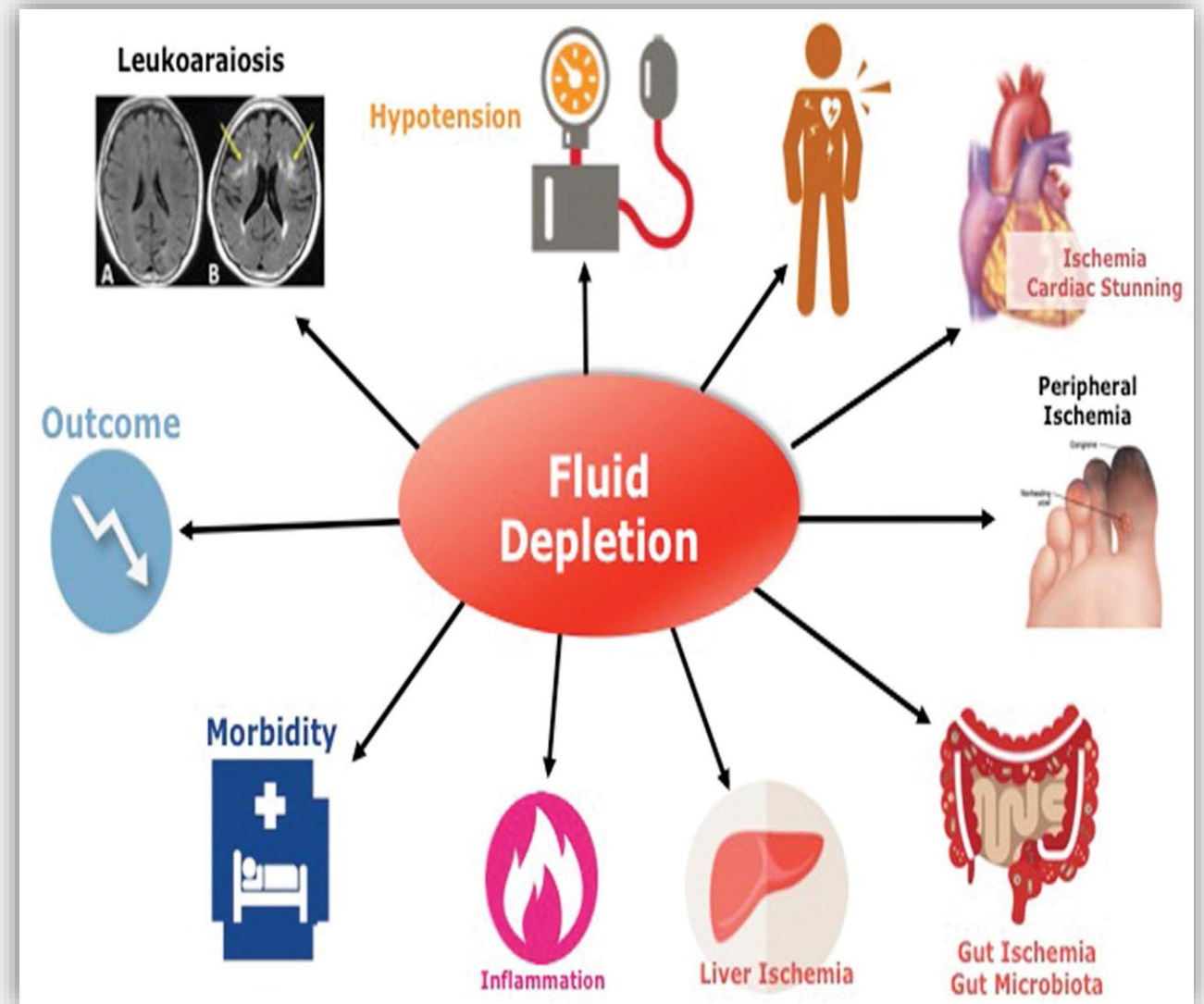
- To stabilize blood pressure.
- Address dehydration.

- 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.

DIALYSIS & IV FLUID

Colloids

vs

Crystalloids

Includes **Albumin, Dextran, Hydroxyethyl starches (HES), Gelatin**

Includes **Hypotonic, Hypertonic, Isotonic** solutions

Large molecules that stay in intravascular space longer

Small molecules that don't stay too long in intravascular space

Fast at expanding intravascular space & amount administered equal to amount lost

High amount of fluids needed to equal amount lost
(overload: edema)

Risks: allergic reaction, coagulation problems

No allergic reactions or coagulation problems

Cost More

Cost Less and easier to access

DIALYSIS & IV FLUID

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.

A E I O U - Acute Indications for Dialysis

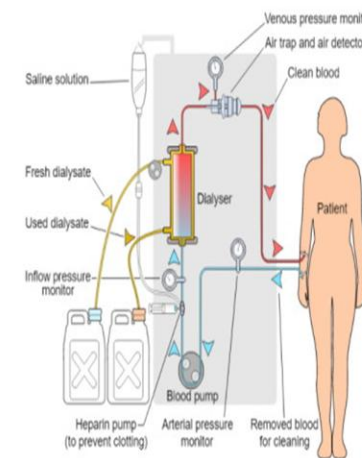
A Acidosis
(pH < 7.1)

E Electrolytes
Refractory Hyperkalemia

I Intoxication / Ingestions
Toxic Alcohols, Salicylates, Lithium, etc

O Overload
Congestive Heart Failure

U Uremia
Uremic Pericarditis, Uremic Encephalopathy

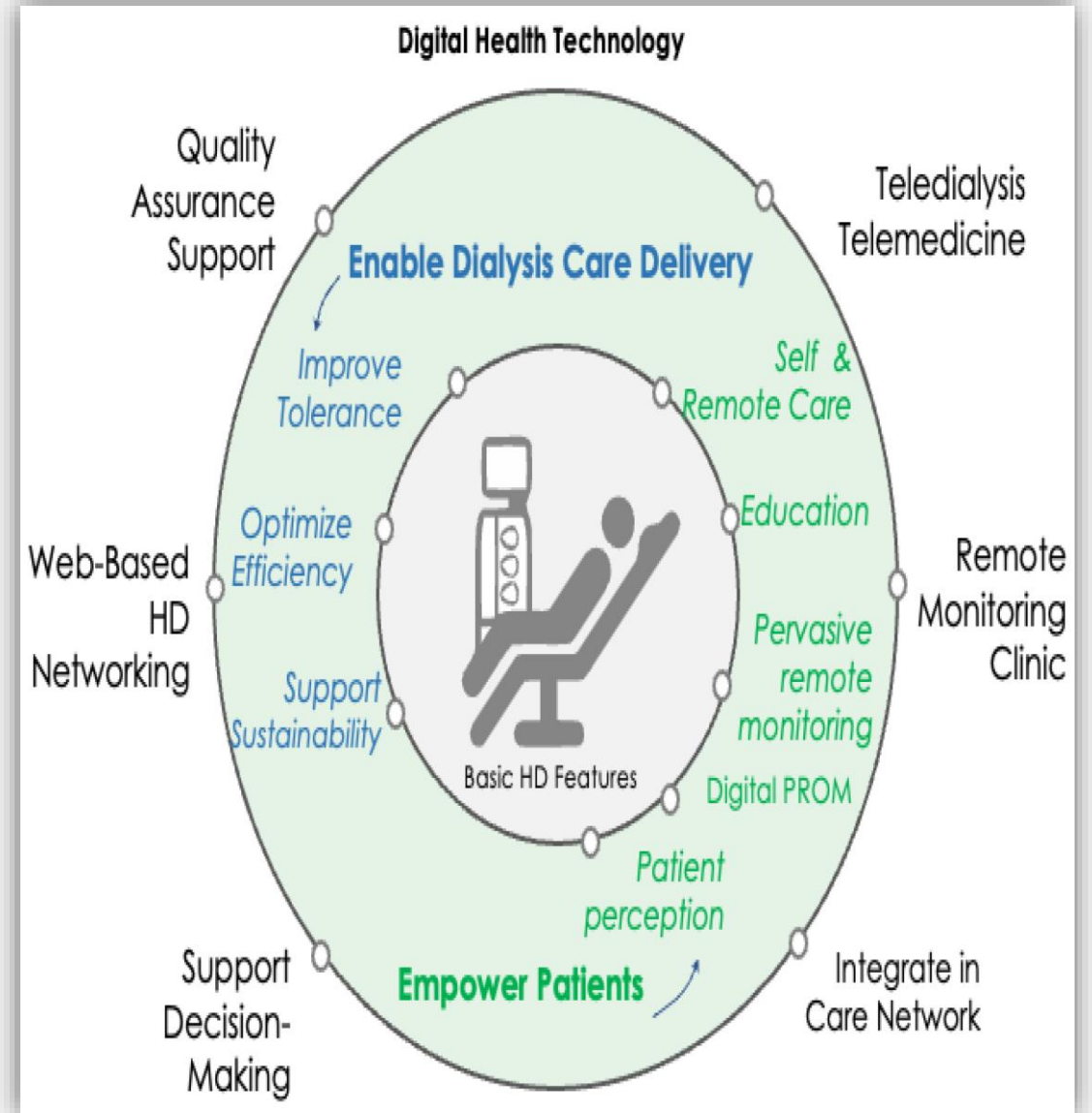


DIALYSIS & IV FLUID

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

FOR YOUR

ATTENTION