आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

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IFTM University, Moradabad

A Presentation

On

“Renal Dialysis”

by

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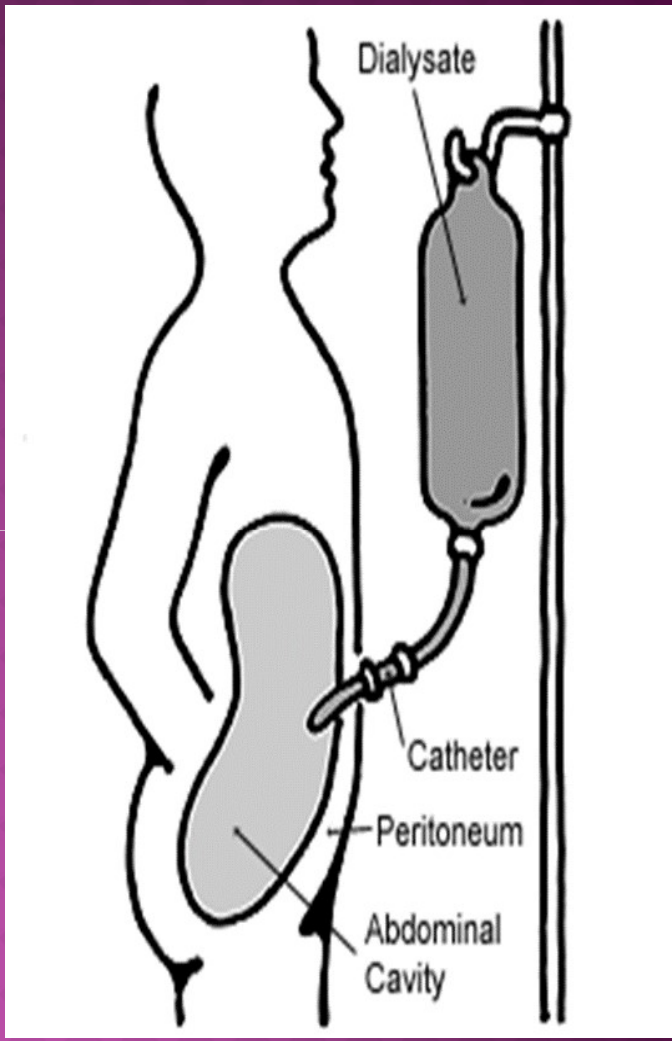
RENAL DIALYSIS



DIALYSIS

- is a p(from Greek dialusis,"", meaning dissolution, dia, meaning through, and lysis, meaning loosening or splitting)
- rocess for **removing waste and excess water** from the blood and is used primarily as an **artificial replacement for lost kidney function** in people with kidney failure.

PURPOSE OF DIALYSIS

- is used to **remove fluid and uremic waste products** from the body when the kidneys cannot do so.
- It may also be used to **treat patients with edema** that does not respond to treatment, **hepatic coma, hyperkalemia, hypercalcemia, hypertension, and uremia**.

INDICATIONS FOR DIALYSIS

- The need for dialysis may be acute or chronic.

1. Acute dialysis is indicated

A. when there is a high and rising level of serum potassium, fluid overload, or impending pulmonary edema, increasing acidosis, pericarditis, and severe confusion.

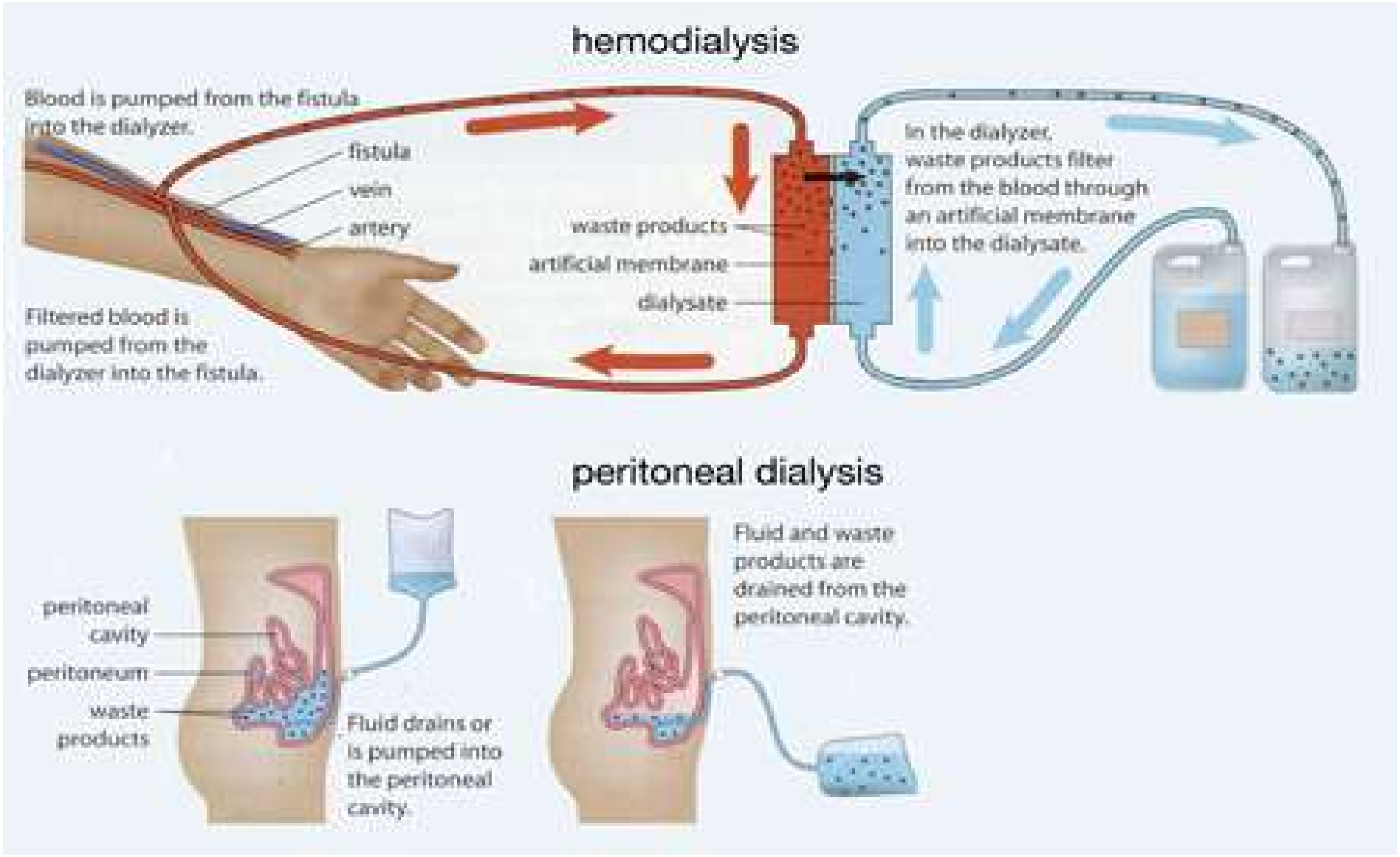
B. to remove certain medications or other toxins (poisoning or medication overdose) from the blood.

2. **Chronic or maintenance dialysis** is indicated in **chronic renal failure**, known as end-stage renal disease (ESRD

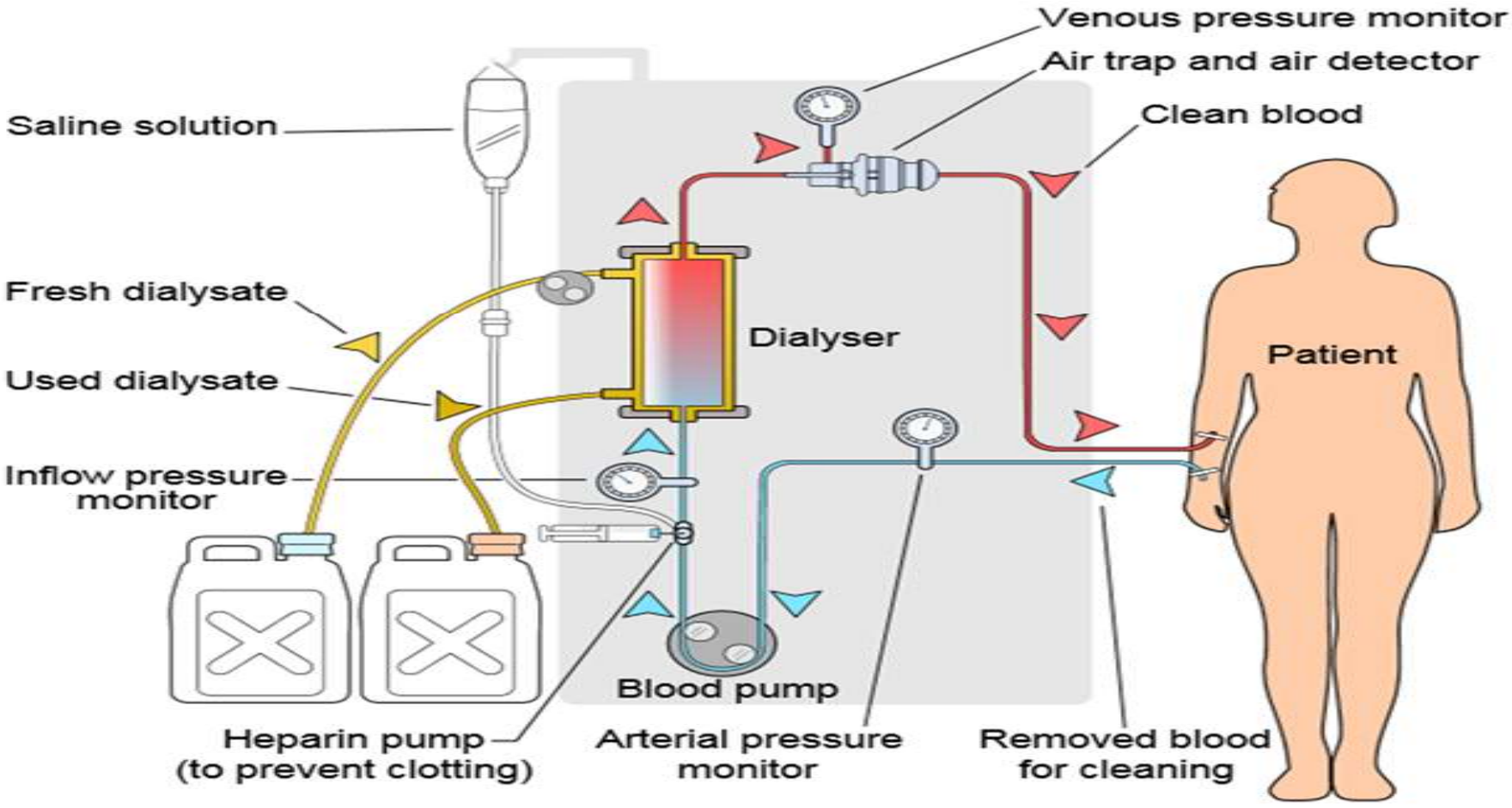
TWO MAIN TYPES OF DIALYSIS

1. HEMODIALYSIS

- most commonly used method of dialysis for patients who are acutely ill and require short-term dialysis (days to weeks)
- Indicated for patients with **ESRD who require long-term or permanent therapy**.
- Patients receiving hemodialysis must undergo treatment for the **rest of their lives** or **until they undergo a successful kidney transplant.**
- Treatments usually occur **three times a week** for at least **3 to 4 hours per treatment** (some patients undergo short-daily hemodialysis;)


hemodialysis
Blood is pumped from the fistula into the dialyzer.
fistula
vein
artery
waste products
artificial membrane
dialysate
In the dialyzer, waste products filter from the blood through an artificial membrane into the dialysate.
Filtered blood is pumped from the dialyzer into the fistula.
peritoneal dialysis
peritoneal cavity
peritoneum
waste products
Fluid drains or is pumped into the peritoneal cavity.
Fluid and waste products are drained from the peritoneal cavity.

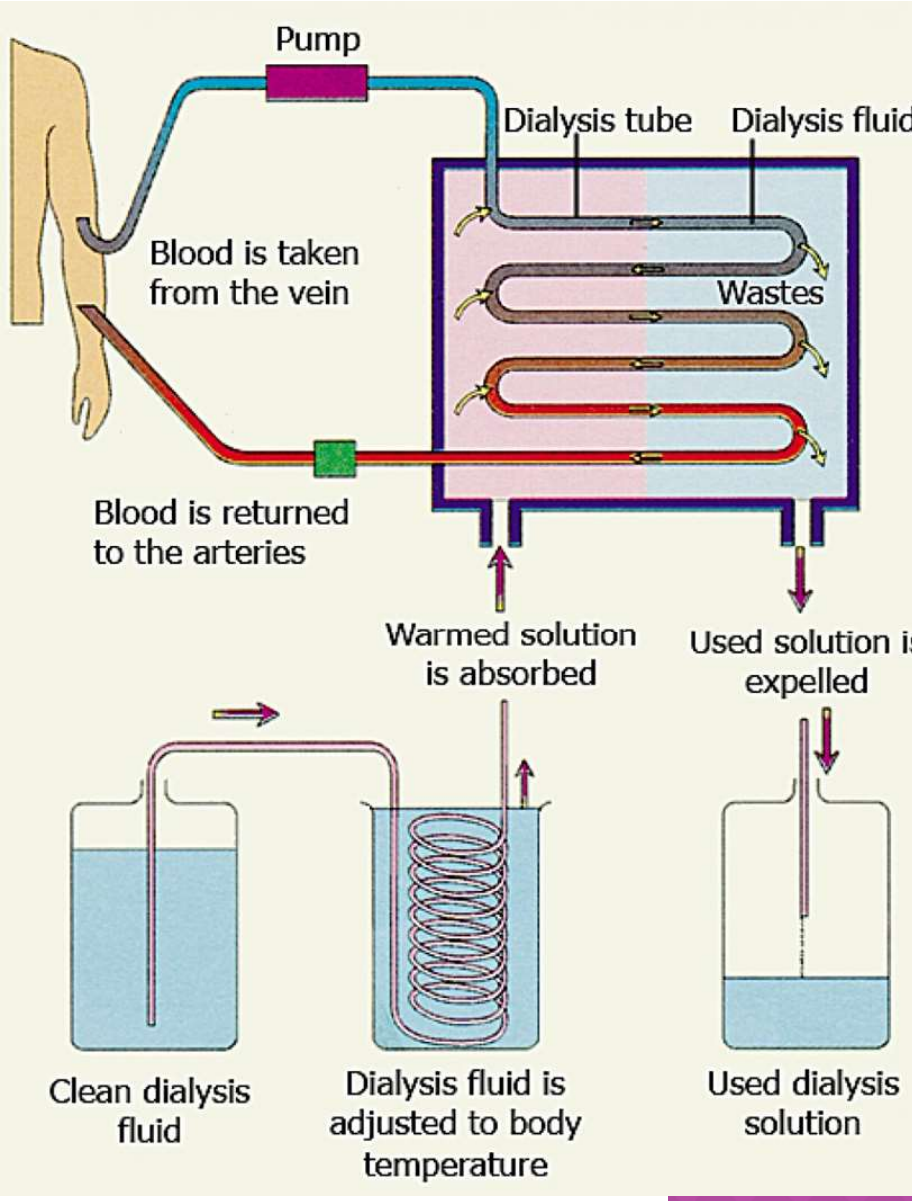
HEMODIALYSIS



In hemodialysis, the patient’s blood is pumped to the dialyzer at a rate of 300 to 600 ml/min. An anticoagulant (usually heparin) is administered to prevent clotting in the dialyzer. The dialysate is pumped at a rate of 500 to 1,000 ml/min through the dialyzer countercurrent to the flow of blood. The rate of fluid removal from the patient is controlled by adjusting the pressure in the dialysate compartment.

HEMODIALYSIS

- removes wastes and water by circulating blood outside the body
- The anticoagulant **heparin** is administered to keep blood from clotting in the dialysis circuit
- The cleansed blood is then returned via the circuit back to the body
- By the end of the dialysis treatment, many waste products have been removed, the electrolyte balance has been restored to normal, and the buffer system has been replenished.



ADVANTAGES AND DISADVANTAGES OF HEMODIALYSIS

Advantages

1. Higher solute clearance allows intermittent treatment.
2. Parameters of adequacy of dialysis are better
3. Technique failure rate is low.
4. intermittent heparinization is required, hemostasis parameters are better corrected with hemodialysis than peritoneal dialysis.

Disadvantages

- In-center hemodialysis enables closer monitoring of the patient.
- Requires multiple visits each week to the hemodialysis center, which translates into loss of control by the patient.
- Disequilibrium, dialysis hypotension, and muscle cramps are common. May require months before the patient adjusts to hemodialysis.
- Infections in hemodialysis patients may be related to the choice of membranes, the complement-activating membranes being more deleterious.
- 4. Vascular access is frequently associated with infection and thrombosis.
- 5. Decline of residual renal function is more rapid compared to peritoneal

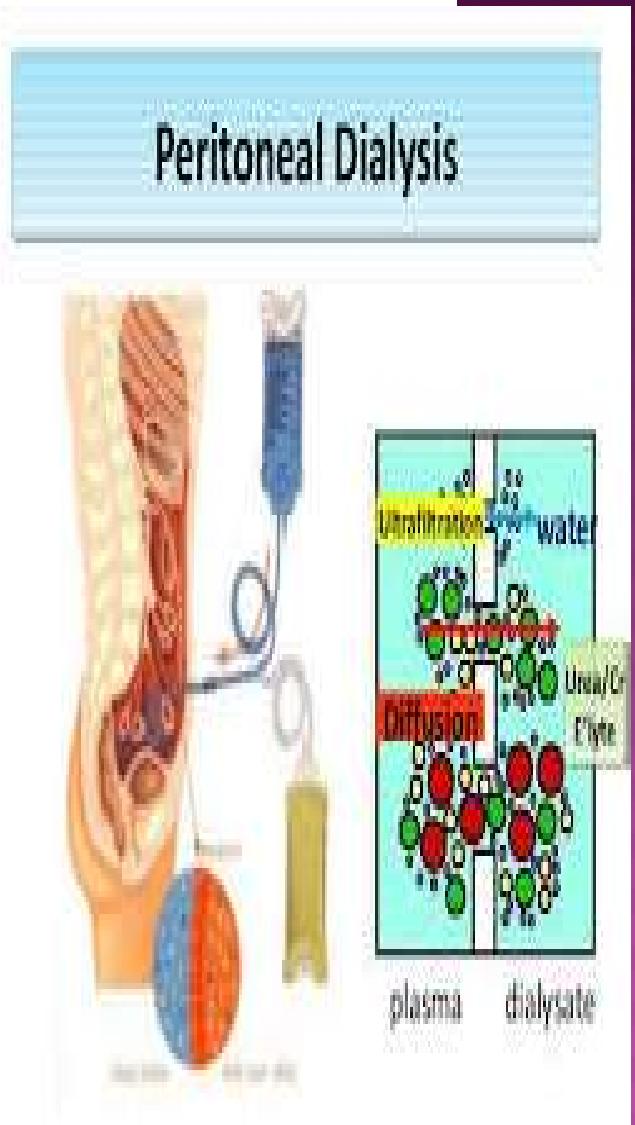
EQUIPMENT FOR HEMODIALYSIS

- **Dialyzers** (artificial kidneys) are either flat-plate dialyzers or hollow-fiber artificial kidneys that contain thousands of tiny cellophane tubules that act as semipermeable membranes.
- **Dialysate -** a solution with minerals (potassium and calcium) flows in the opposite direction with the blood circulating around the tubules

PRINCIPLES OF HEMODIALYSIS

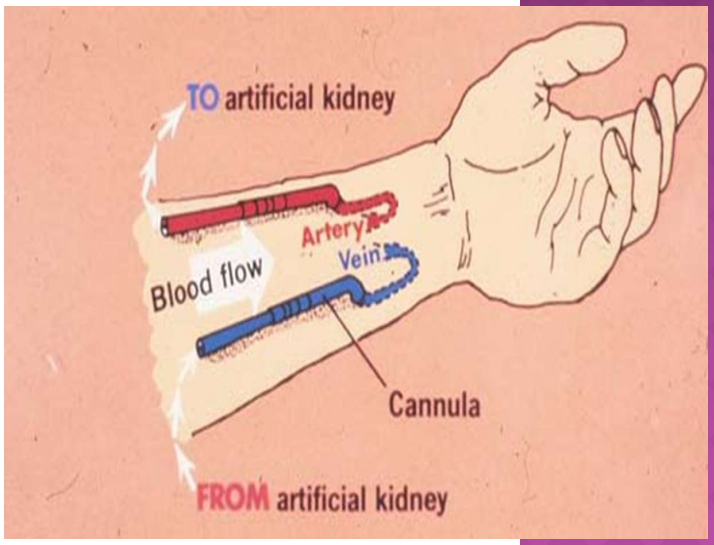
- The objectives of hemodialysis are **to extract toxic nitrogenous substances from the blood and to remove excess water**.
- In hemodialysis, the blood the blood, loaded with toxins and nitrogenous wastes, is diverted from the patient to a **dialyzer**, in which is cleansed and then returned to the patient.

1. **Diffusion** – movement from higher concentration (blood) to lower concentration (dialysate). The toxins and wastes in the blood are removed
2. **Osmosis -** Excess water is removed from the blood by osmosis, in which water moves from an area of higher solute concentration (the blood) to an area of lower solute concentration (the dialysate bath).
3. **Ultrafiltration** - water moving under high pressure to an area of lower pressure by **negative pressure** or a suctioning force to the dialysis membrane.



VASCULAR ACCESS

- Access to the patient's vascular system must be established to allow blood to be removed, cleansed, and returned to the patient's vascular system at rates between 200 and 800 mL/minute.
- **SUBCLAVIAN, INTERNAL, JUGULAR, AND FEMORAL CATHETERS**
- **FISTULA** - A more permanent access is created surgically (usually in the forearm) by joining (anastomosing) an artery to a vein, either side to side or end to side. The fistula takes 4 to 6 weeks to mature before it is ready for use
- **GRAFT** - An arteriovenous graft can be created subcutaneously when the patient's vessels are not suitable for a fistula; usually placed in the forearm, upper arm, or upper thigh.

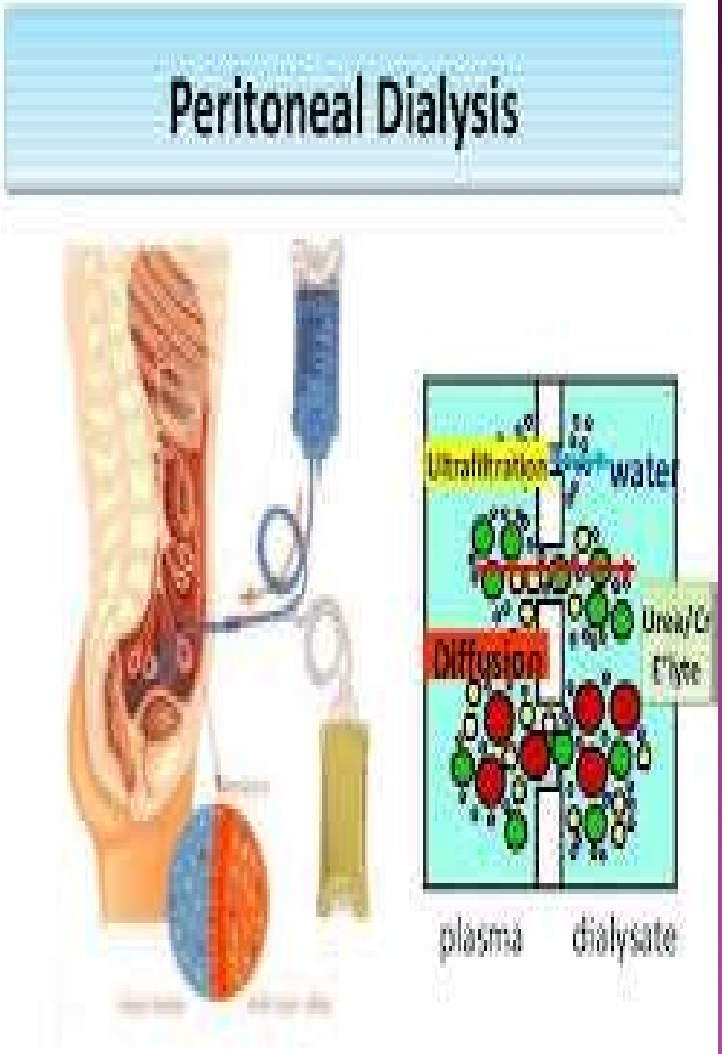


COMPLICATIONS OF HEMODIALYSIS

- **During dialysis** (hypotension, arrhythmias, exsanguination, seizures, fever)
- **Between treatments** (Hypertension/Hypotension, Edema, Pulmonary edema, Hyperkalemia, Bleeding, Clotting of access
- **Long term** : Hyperparathyroidism, CHF, AV access failure, pulmonary edema, neuropathy, anemia, GI bleeding,

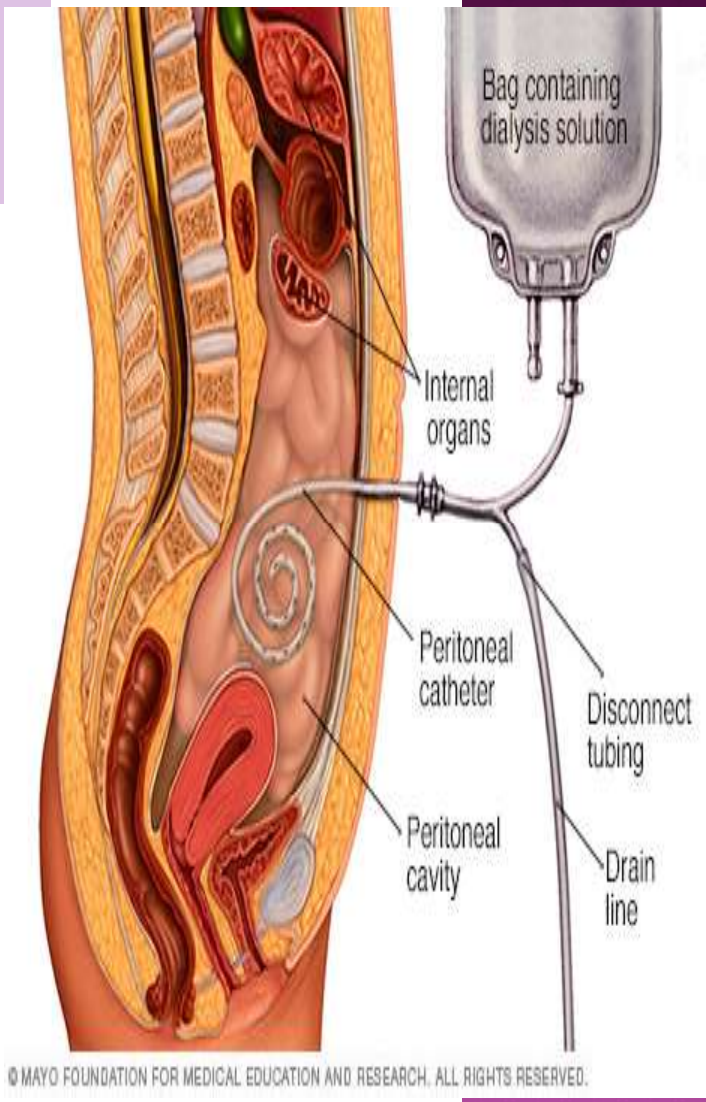
2. PERITONEAL DIALYSIS

- wastes and water are removed from the blood inside the body using the peritoneum as a natural semipermeable membrane.
- Wastes and excess water move from the blood, across the peritoneal membrane, and into a special dialysis solution, called dialysate,



INDICATIONS FOR PERITONEAL DIALYSIS

- Peritoneal dialysis may be the t**reatment of choice** for patients with renal failure who are unable or unwilling to undergo hemodialysis or renal transplantation.
- patients with diabetes or cardiovascular disease,
- many older patients, and those who may be at risk for adverse effects of systemic heparin



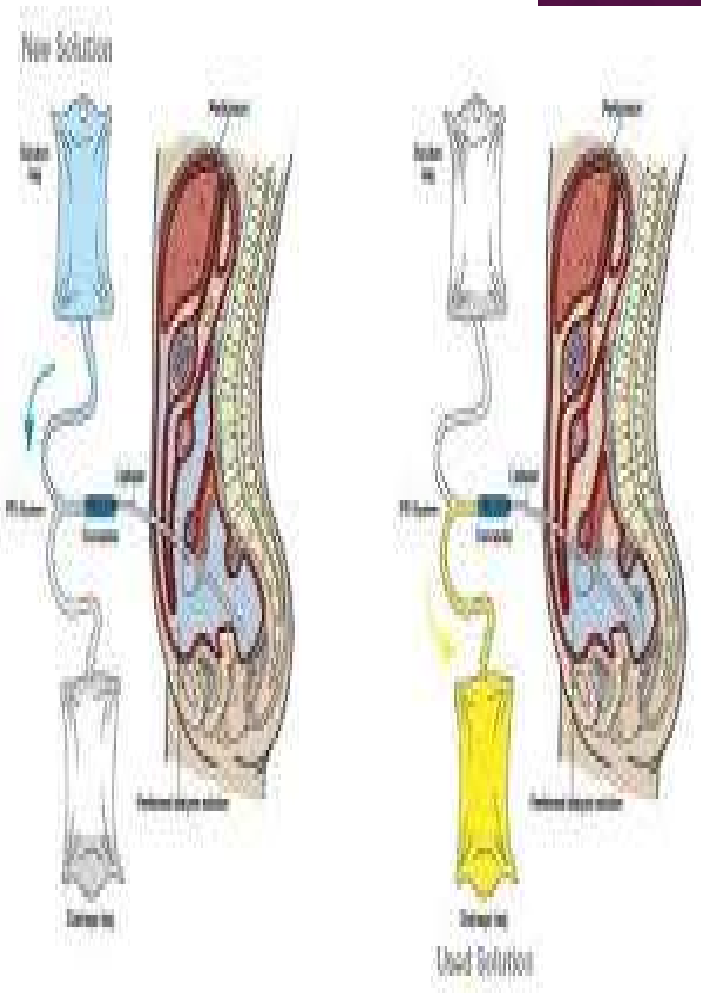
PERITONEAL DIALYSIS SOLUTIONS

- All forms of PD use the same dialysate solutions, which are commercially available in volumes of 1 to 3 L in flexible polyvinyl chloride plastic bags. Commercial PD solutions include varying concentrations of electrolytes, such as sodium (132 mEq/L), chloride (96 to 102 mEq/L), calcium (0 to 3.5 mEq/L), magnesium (0.5 mEq/L), and lactate (35 to 40 mEq/L). Dialysate pH is maintained at 5.2.63 The PD dialysate solution may contain 1.5%, 2.5%, 3.86%, or 4.25% dextrose or icodextrin (a glucose polymer) at a concentration of 7.5%. The dextrose solutions are hyperosmolar (osmolarity ranges from 346 to 485 mOsm/L) and induce ultrafiltration (removal of free water) by crystalline osmosis. Dextrose is not the ideal osmotic agent for peritoneal dialysate because these solutions are not biocompatible with peritoneal mesothelial cells or with peritoneal leukocytes.64 The cytotoxic effects on these cells are mediated by the osmolar load and the low pH of the solutions, as well as the presence of glucose degradation products formed during heat sterilization of these products. Icodextrin PD solution contains icodextrin, a starch-derived glucose polymer. It has an osmolality of 282 to 286 mOsm/L, which s isoosmolar with serum. Icodextrin produces prolonged ultrafiltration by a mechanism resembling colloid osmosis resulting in ultrafiltration volumes similar to those with 4.25% dextrose. Icodextrin may have fewer of the metabolic effects associated with dextrose, such as hyperglycemia and weight gain. It is indicated for use during the long (8 to 16 hours) dwell of a single daily exchange in CAPD and APD patients.65

PROCEDURE FOR PERITONEAL DIALYSIS

PREPARING THE PATIENT .

1. The nurse explains the procedure to the patient and obtains **signed consent** for it.
2. Baseline vital signs, weight, and serum electrolyte levels are recorded.
3. The patient is encouraged to **empty the bladder and bowel** to reduce the risk of puncturing internal organs.
4. Broad-spectrum antibiotic agents may be administered to prevent infection.



PROCEDURE FOR PERITONEAL DIALYSIS

PREPARING THE EQUIPMENT (apply Strict Aseptic technique)

1. Consults the physician to determine the concentration of dialysate to be used and the medications to be added to it. (Heparin , Potassium chloride , Antibiotics' Insulin) .
2. Before medications are added, the dialysate is **warmed to body** temperature to prevent patient discomfort and abdominal pain and to dilate the vessels of the peritoneum to increase urea clearance. **Solutions that are too cold cause pain and vasoconstriction** and reduce clearance. Solutions that are **too hot burn the peritoneum.**

Procedure for Peritoneal dialysis

PREPARING THE EQUIPMENT (apply Strict Aseptic technique)

3. Assemble the administration set and tubing. Fill the tubing with the prepared dialysate to reduce the amount of air entering the catheter and peritoneal cavity, which could **increase abdominal discomfort and interfere with instillation** and drainage of the fluid.

INSERTING THE CATHETER

- Ideally, the peritoneal catheter is inserted in the **operating room** to maintain surgical asepsis and minimize the risk of contamination. In some circumstances, however, the physician inserts the catheter at the **bedside under strict asepsis.**

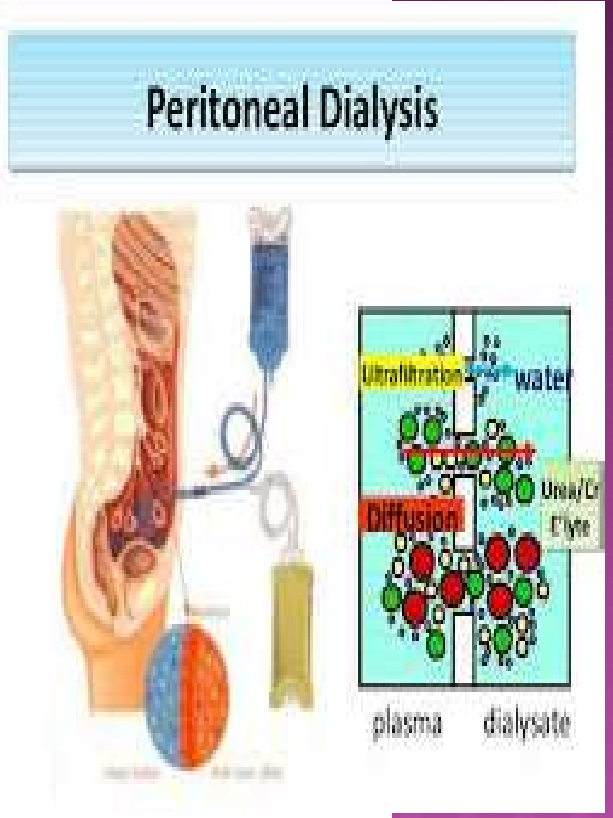
PERFORMING THE EXCHANGE

(1 TO 4 HOURS, DEPENDING ON THE PRESCRIBED DWELL TIME.)

- Peritoneal dialysis involves a series of exchanges or cycles which is repeated throughout the course of the dialysis which is based on the patient's **physical status and acuity of illness.**
- An exchange is defined as the **infusion, dwell, and drainage of the dialysate**.

INFUSION : The dialysate is infused by gravity into the peritoneal cavity for a period of about 5 to 10 minutes to infuse 2 L of fluid.

DWELL: (equilibration time) allows diffusion and osmosis to occur. (peaks in the first 5 to 10 minutes)

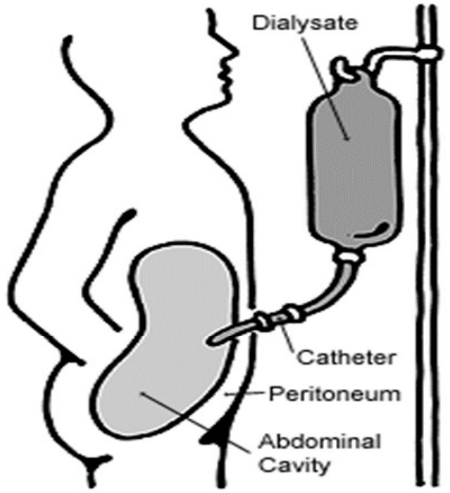


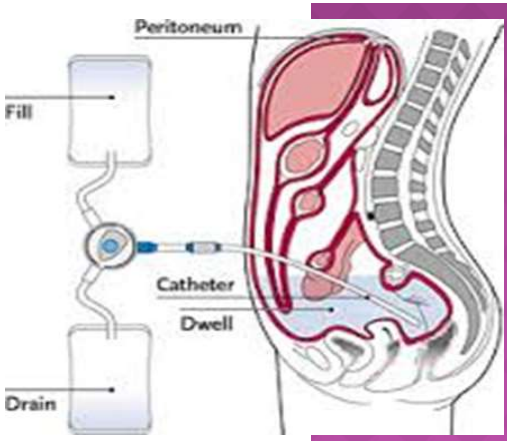
PERFORMING THE EXCHANGE

(1 TO 4 HOURS, DEPENDING ON THE PRESCRIBED DWELL TIME.)

DRAINAGE

- The tube is unclamped and the solution drains from the peritoneal cavity by gravity through a closed system (10 to 30 minutes).
- The drainage fluid **is normally colorless** or **straw-colored** and should **not be cloudy.** Bloody drainage may be seen in the first few exchanges after insertion of a new catheter but should not occur after that time.
- The removal of excess water during peritoneal dialysis is achieved by using a **hypertonic dialysate** with a high dextrose concentration that creates an osmotic gradient (Dextrose solutions of 1.5%, 2.5%, and 4.25%).





NURSING RESPONSIBILITY

- Maintain the cycle in a **Strict aseptic technique**
- Vital signs, weight, intake and output, laboratory values, and patient status are frequently monitored.
- Assesses skin turgor and mucous membranes to evaluate fluid status and monitor the patient for edema.
- Facilitate drainage by **turning the patient from side to side** or raising the head of the bed, checking the patency of the catheter by inspecting for kinks, closed clamps, or an air lock.
- **Monitor for complications,** including peritonitis, bleeding, respiratory difficulty, and leakage of peritoneal fluid.

NURSING RESPONSIBILITY

- Measure **abdominal girth** to determine if the patient is retaining large amounts of dialysis solution.
- Ensure that the peritoneal dialysis catheter remains **secure** and that the **dressing remains dry.** **The catheter should never be pushed in.**
- Use a **flow sheet to document** each exchange and record vital signs, dialysate concentration, medications added, exchange volume, dwell time, dialysate fluid balance for the exchange (fluid lost or gained), and cumulative fluid balance

COMPLICATIONS OF PERITONEAL DIALYSIS

- **PERITONITIS** (inflammation of the peritoneum) is the most common and most serious complication; characterized by cloudy dialysate drainage, diffuse abdominal pain, and rebound tenderness.
- **LEAKAGE** of dialysate through the catheter site may occur immediately after the catheter is inserted
- **BLEEDING** - common during the first few exchanges after a new catheter insertion because some blood exists in the abdominal cavity from the procedure.

LONG-TERM COMPLICATIONS

- Hypertriglyceridemia ; abdominal hernias (incisional, inguinal, diaphragmatic, and umbilical), hemorrhoids.

Advantages and Disadvantages of Peritoneal Dialysis

Advantages

- More HD stability (blood pressure) due to slow ultrafiltration rate.
- Increased clearance of larger solutes, which may explain good clinical status in spite of lower urea clearance. Better preservation of residual renal function.
- Convenient intraperitoneal route for administration of drugs such as antibiotics and insulin.
- Suitable for elderly and very young patients who may not tolerate hemodialysis well.
- Freedom from the “machine” gives the patient a sense of independence (for continuous ambulatory peritoneal dialysis).
- Less blood loss and iron deficiency, resulting in easier management of anemia or reduced requirements for erythropoietin and parenteral iron.
- No systemic heparinization required.
- Subcutaneous versus intravenous erythropoietin or darbepoetin is usual, which
- may reduce overall doses and be more physiologic.

- **Disadvantages**
- Protein and amino acid losses through peritoneum & reduced appetite owing to continuous glucose load and sense of abdominal fullness predispose to malnutrition.
- Risk of peritonitis.
- Catheter malfunction, exit site, and tunnel infection.
- Inadequate ultrafiltration and solute dialysis in patients with a large body size, unless large volumes and frequent exchanges are employed.
- Patient burnout and high rate of technique failure.
- Risk of obesity with excessive glucose absorption.
- Mechanical problems such as hernias, dialysate leaks, hemorrhoids, or back pain
- more common than HD.
- Extensive abdominal surgery may preclude peritoneal dialysis.
- No convenient access for intravenous iron administration.


Thank you...