

DIALYSIS

BASIC FUNCTION OF KIDNEY

- ▶ Kidney performs the functions such as excretion of waste products from metabolic processes.
- ▶ Regulation of constancy of blood fluids
- ▶ Constant blood pH
- ▶ Blood pressure maintenance
- ▶ Regulation of various blood chemicals

Dialysis is broadly classified into two types

1) Peritoneal dialysis 2) Hemodialysis

1. Peritoneal dialysis

Dialysis which is performed under emergency condition. This dialysis is done by puncturing two needles through the abdominal (peritoneum) and washed out the peritoneal cavity with a saline solution.

2. Hemodialysis

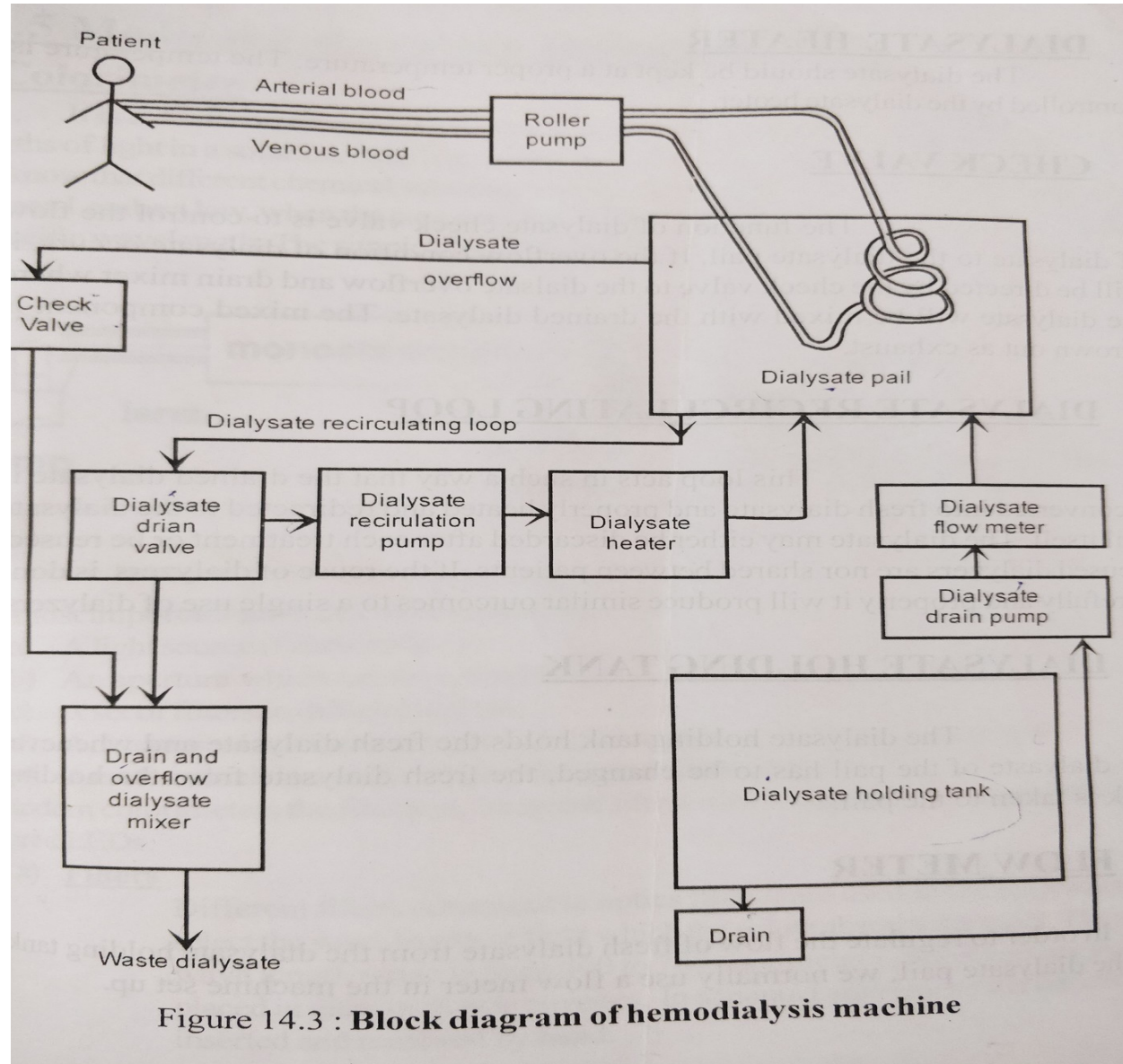
Method of removing waste products such as potassium and urea from the blood when kidneys are in failure. The chemical substance are removed from the blood by passing it through tubes surrounded by semi- permeable membrane.

The coiled tube surrounded by semi permeable membrane is immersed in a dialysate solution. It uses counter flow where the dialysate is flowing in the opposite direction of blood flow. Fluid removal (ultra filtration) is achieved by altering the hydrostatic pressure of the dialysate solution.

Free water and some dissolved solutes to move across the membrane. Toxins such as urea, uric acid gradually pass through plastic tubes into dialysate solution. The semi permeable membrane does not allow blood cells and large protein molecules .

- ▶ The hemodialysis machine pumps the patients blood and dialysate through the dialyzer.
- ▶ An extensive water purification system is necessary for hemodialysis machine. If the water used in dialysis procedure is not carefully filtered mineral contaminations or bacterial endotoxins can enter into patients body cause many health problems.
- ▶ Initially water is filtered and temperature adjusted and its pH is corrected by adding an acid or base. Primary purification is done by forcing water through a permeable membrane, this membrane is called reverse osmosis membrane.
- ▶ Once purified water is mixed with dialysate concentrate, its conductivity increases. Dialysate solution contains salts of calcium, magnesium, potassium, sodium etc.
- ▶ During dialysis the conductivity of dialysate solution is continuously monitored to ensure that the water and dialysate concentrate are mixed in proper proportions.

BLOCK DIAGRAM OF HEMODIALYSIS MACHINE



BLOCK DIAGRAM AND EXPLANATION

The blood is taken out from the artery of the patient and mixed with an anticoagulant such as heparin and pumped into the apparatus called artificial kidney or hemodialysis machine.

1. DIALYSATE PAIL

Dialysate pail is the storage place of the dialysate. It is through the dialysate that the blood from the patient is directed to flow through channels or tubes bounded by cellophane membrane. This membrane is permeable to small solutes and impermeable to macromolecules.

2. DIALYZER

Dialyzer is the major part of equipment that actually filters the blood. Dialyzer membranes have different pore sizes. Those with smaller pore size is called low flux membrane and those with larger pore size are called high flux membranes. Dialyzer membranes used is made of cellulose. Another group of membrane is made from synthetic materials using polymers. Nanotechnology is used in some high flux membranes to create uniform pore size. Dialyzers come in many different sizes. A larger dialyzer with a larger membrane can remove more solutes.

3. DIALYSATE HEATER

The dialysate should be kept at a proper temperature. The temperature is controlled by the dialysate heater.

4. CHECK VALVE

The function of dialysate check valve is to control the flow of dialysate to the dialysate pail. If the overflow condition of dialysate occurs, it will be directed by the check valve to the dialysate overflow and drain mixer where the dialysate will be mixed with the drained dialysate. The mixed component is thrown out as exhaust.

5. DIALYSATE RECIRCULATING LOOP

This loop acts in such a way that the drained dialysate is reconverted into fresh dialysate and properly heated and redirected to the dialysate pail itself. The dialysate may either be discarded after each treatment or be reused. Reused dialyzers are not shared between patients. If the reuse of dialyzers is done carefully and properly it will produce similar outcomes to a single use of dialyzers.

6. DIALYSATE HOLDING TANK

The dialysate holding tank holds the fresh dialysate and whenever the dialysate of the pail has to be changed, the fresh dialysate from the holding tank is taken to the pail.

7. FLOW METER

In order to regulate the flow of fresh dialysate from the dialysate holding tank to the dialysate pail, we normally use a flow meter in the machine set up.