Management of CKD

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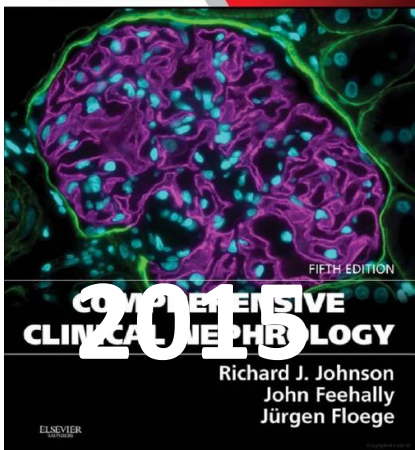
Definition

- Kidney damage or an estimated glomerular filtration rate (eGFR) below 60 ml/min/1.73m^2
- Persisting for 3 months or more irrespective of the cause

Classification of CKD Based on GFR

CKD Stage	Definition
1	Normal or increased GFR; some evidence of kidney damage reflected by microalbuminuria, proteinuria, and hematuria as well as radiologic or histologic changes
2	Mild decrease in GFR (89–60 ml/min per 1.73 m^2) with some evidence of kidney damage reflected by microalbuminuria, proteinuria and hematuria as well as radiologic or histologic changes
3 3A 3B	GFR 59-30 ml/min per 1.73 m^2 GFR 59 to 45 ml/min per 1.73 m^2 GFR 44 to 30 ml/min per 1.73 m^2
4	GFR 29-15 ml/min per 1.73 m^2
5	GFR <15 ml/min per 1.73 m^2; when renal replacement therapy in the form of dialysis or transplantation has to be considered to sustain life

The suffix p to be added to the stage in proteinuric patients (proteinuria >0.5 g/24h)



Investigations

1. Urine examination :

- Polyuria especially nocturia and anuria in terminal cases.
- Urine specific gravity is low and fixed to 1010 (osmolarity 300 mosm/l).
- Urine aspect is pale and watery.
- Albuminuria and granular casts.

2. Blood Changes:

- Increase in blood urea, creatinine and uric acid levels
- Metabolic acidosis
- Normochromic normocytic anemia
- Hyperkalemia
- Hyperphosphatemia
- Serum calcium may be normal or low in early phases, but it becomes high in stage of tertiary hyperparathyroidism.

3. Kidney Function Tests:

- increase in s. creatinine and decrease in cr. clearance.
- Plasma creatinine is elevated once GFR is decreased to less than 60 ml/min.

4. Investigations To Know The Cause Of Renal Failure :

- Ultrasonography
- Blood sugar (diabetes)
- Anti DNA (SLE).
- Renal biopsy is indicated in cases with average kidney size and unknown etiology of uremia.

Management

Step 1. CONFIRMATION OF CHRONICITY OF THE KIDNEY DISEASE

a. History: A long history of renal disease suggests chronicity while absent previous history suggests AKI.

b. Kidney size as detected by ultrasonography: A small atrophic kidney favors the diagnosis of CKD, while a normal sized kidneys is more in favor of AKI.

c. Magnitude of the increase in serum creatinine in relation to the presenting symptoms: High serum creatinine with minimal symptoms is in favor of CKD, while relatively low serum creatinine with severe symptoms is in favor of AKI.

d. Hyperphosphataemia and osteodystrophy are present more with chronic cases.

e. Anaemia is more with chronic cases.

f. Renal biopsy: extensive renal interstitial fibrosis and tubular atrophy in renal biopsy are features of chronic cases.

Step 2. SEARCHING FOR REVERSIBLE FACTORS

a. Pre-renal factors:

- Severe cardiac failure.
- Malignant hypertension.
- Hypotension.
- Dehydration and hypovolemia.

b. Renal causes factors such as:

- Active glomerular disease
- Active tubulo-interstitial disease
- Pyelonephritis

c. Postrenal factors:

- Stone
- Stricture ureters
- Enlarged prostate
- Bladder neck obstruction

Step 3. CONSERVATIVE TREATMENT OF CHRONIC RENAL FAILURE

a. Dietary control:

- *Protein restriction* 0.7-0.8 gm/kg/day.
- *Fluid restriction* equivalent to the patient's daily fluid loss.
- *Electrolytes:*
  - Sodium restriction with hypertension or edema
  - Potassium restriction with severe oliguria and with hyperkalemia
- *Calories:* Patient should receive about 35 K. calories/kg/day with carbohydrate 60% of non protein calories and fat 40%.

b. Treatment of Bone disease

- Phosphate Binders
- Active vitamin D " 1-OH vitamin D" given orally in a daily dose of 0.25-1.0 ug.
- Acidosis is corrected by oral Na bicarbonate supplementation.
- *Parathyroidectomy:*
  - May be done for cases with tertiary hyperparathyroidism.
  - Three glands and part of the fourth are removed and the remaining is implanted subcutaneously.

c. Anaemia

- Responsible for major part of uremic symptoms.
- The first line of treatment is by giving proper nutrition, iron, folic acid, and vitamins especially B12.
- Recombinant human Erythropoietin.
- Blood transfusion in urgent and resistant cases
- Targets:
  - HB: 10-11.5 gm/dl
  - Iron:
    - Ferritin ≥ 500 ng/ml
    - TSAT: 30-50%

d. Symptomatic treatment

- *Hypertension* is controlled by hypotensive drugs.
- *Itching:*
  - Skin soothing creams, anti-histaminics, treatment of hyperphosphatemia, hyper and hypocalcaemia.
  - For severe, intractable cases, parathyroidectomy may be of help.
- *G.I.T. manifestations* as vomiting could be controlled by antacids and H2-receptors blockers.

RRT

Haemodialysis

Peritoneal dialysis

Renal transplantation

Indications

- Failure of conservative treatment with progressive deterioration in patient's general condition and blood chemistry.
- Persistent nausea and vomiting.
- Circulatory overload unresponsive to loop diuretics (urgent)
- Severe motor neuropathy.

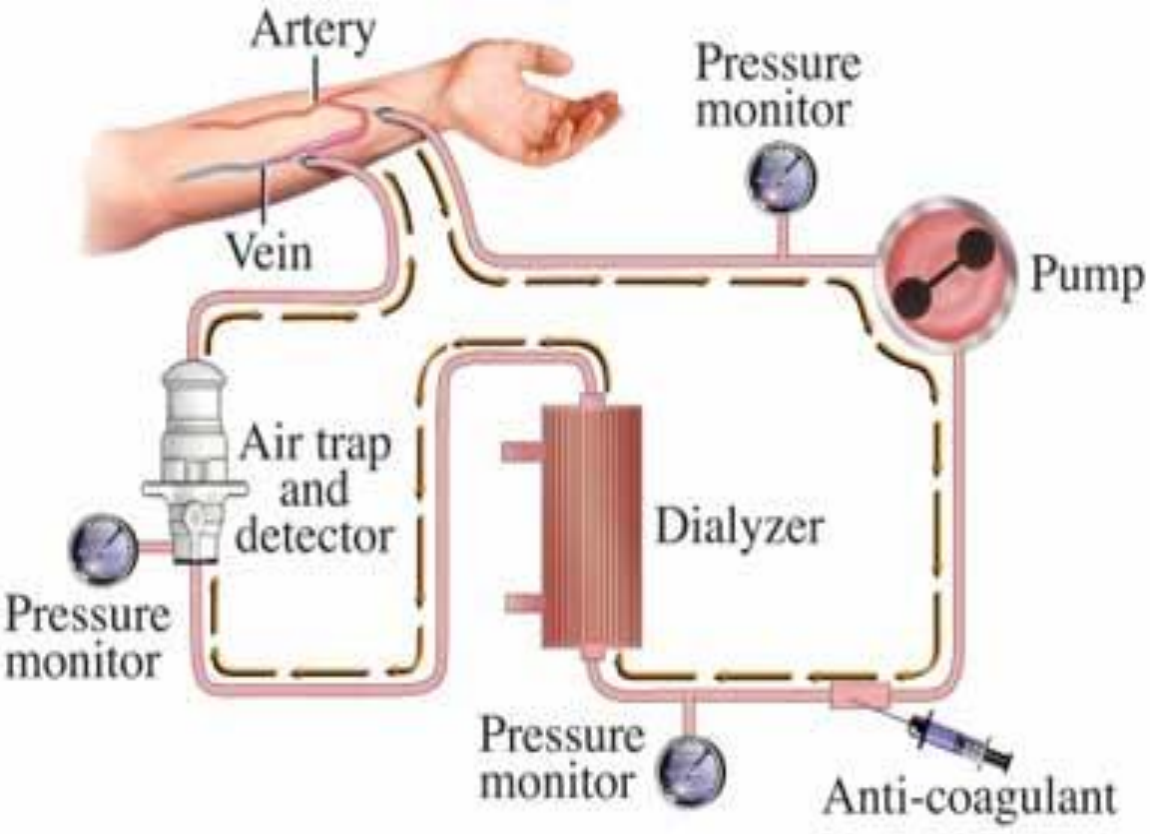
- Uremic encephalopathy (urgent) .
- Pericarditis (urgent).
- Bleeding diathesis.
- Hypertension unresponsive to treatment.
- Hyperkaliemia (serum K+ level > 7 mEq./litre) (urgent).
- Severe metabolic acidosis (PH < 7.1, HCo3 < 10) (urgent).

Contraindications

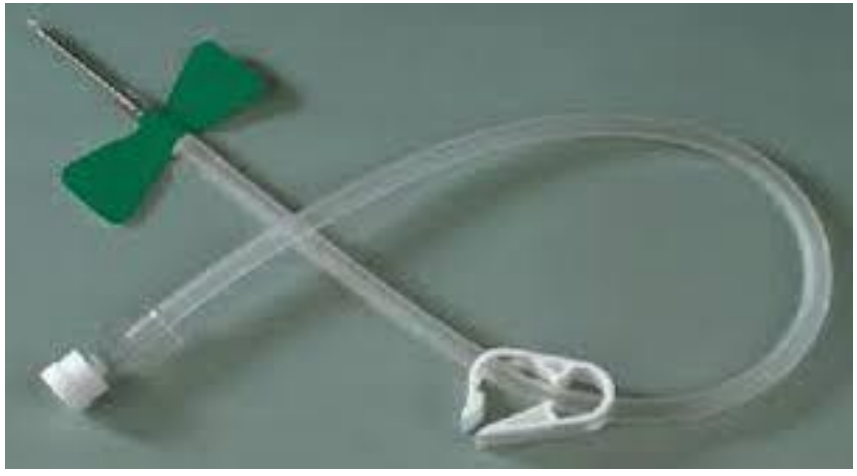
1. **Absolute:**
   - Patient's refusing dialysis.
   - No vascular access possible
2. **Relative:**
   - Difficult vascular access
   - Needle phobia
   - Advanced cardiac failure
   - Coagulopathy

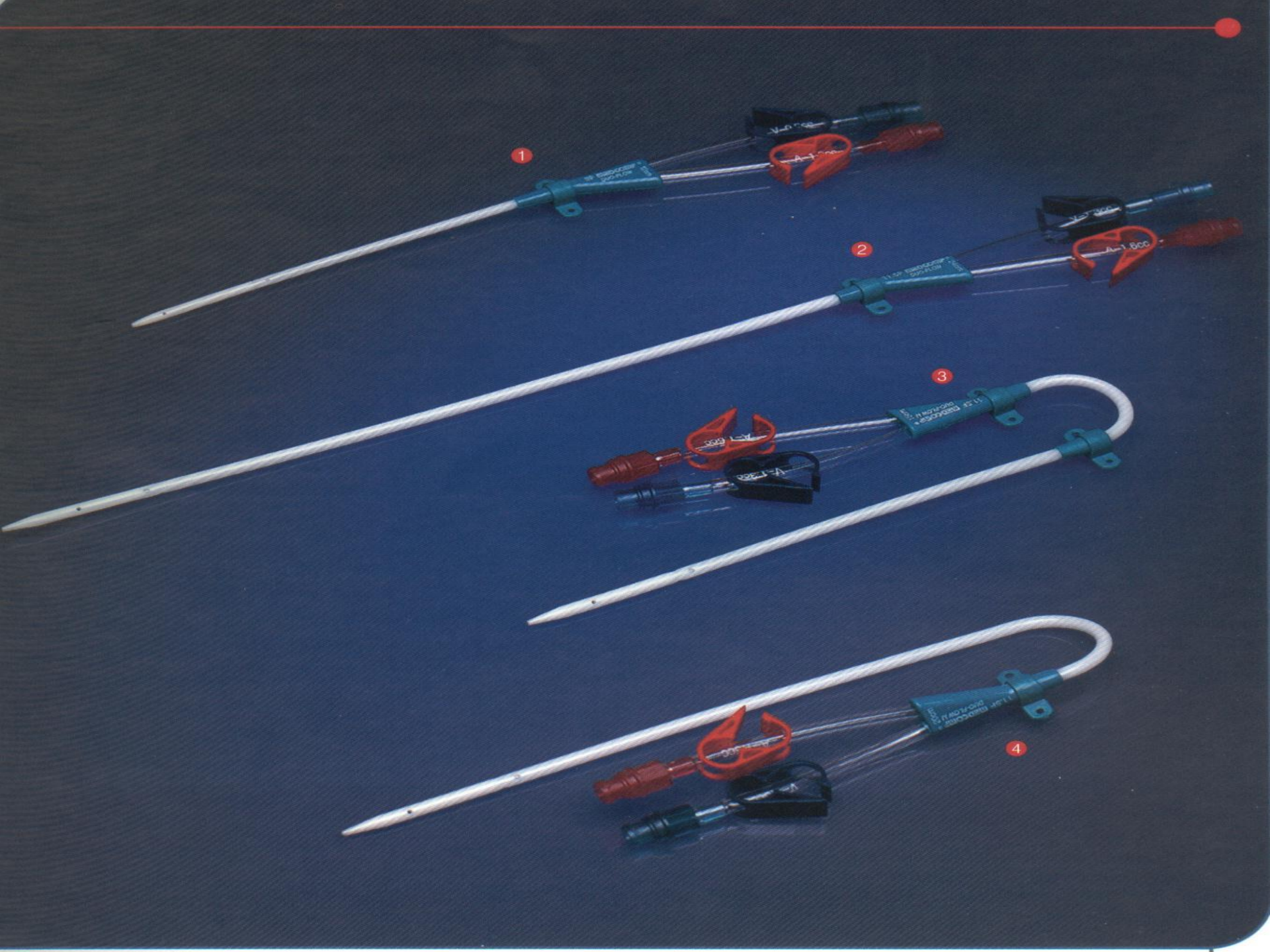
Haemodialysis

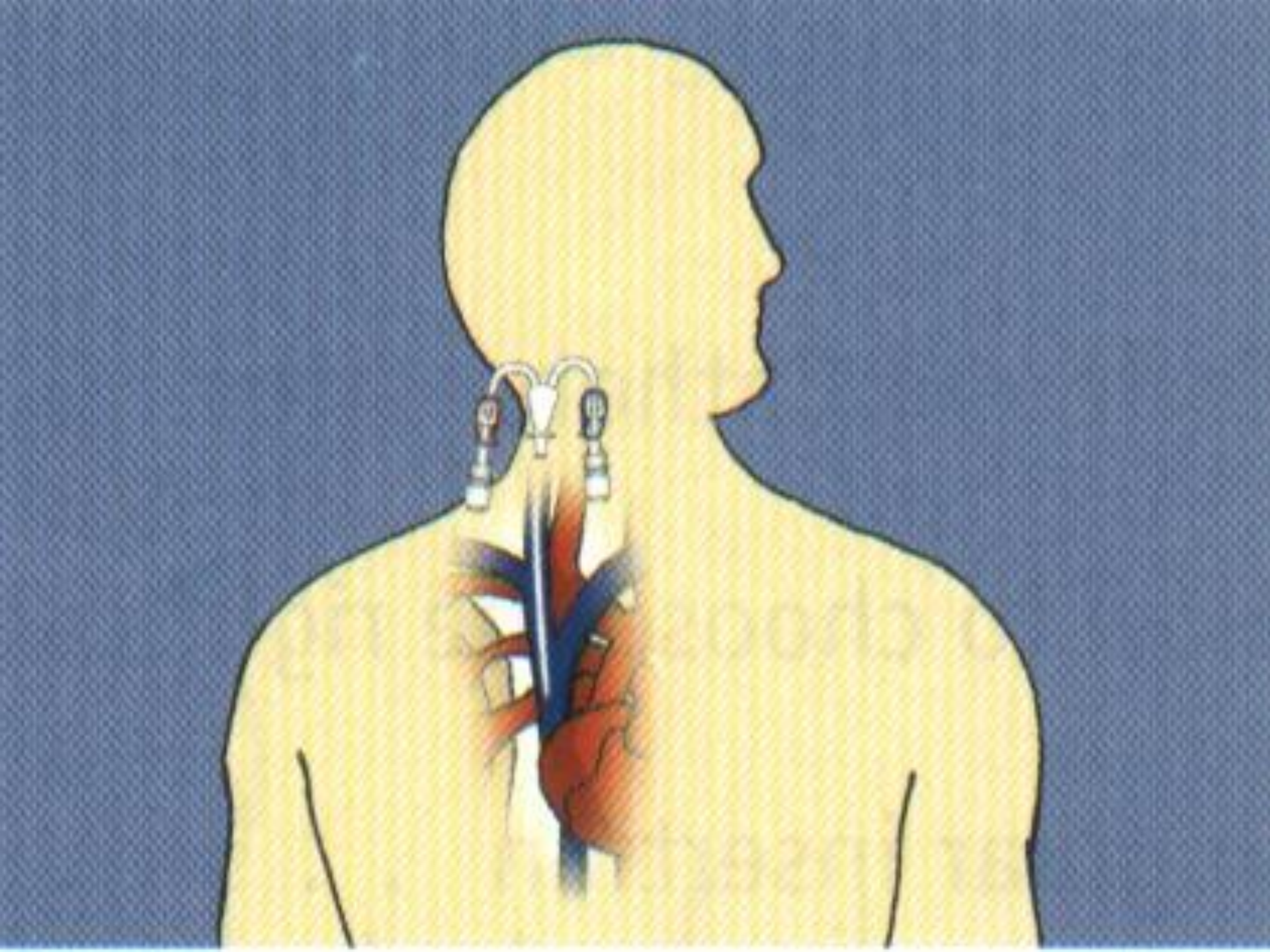
- It is the movement of solutes and water from the patient's blood across a semipermeable membrane which is the dialyzer.

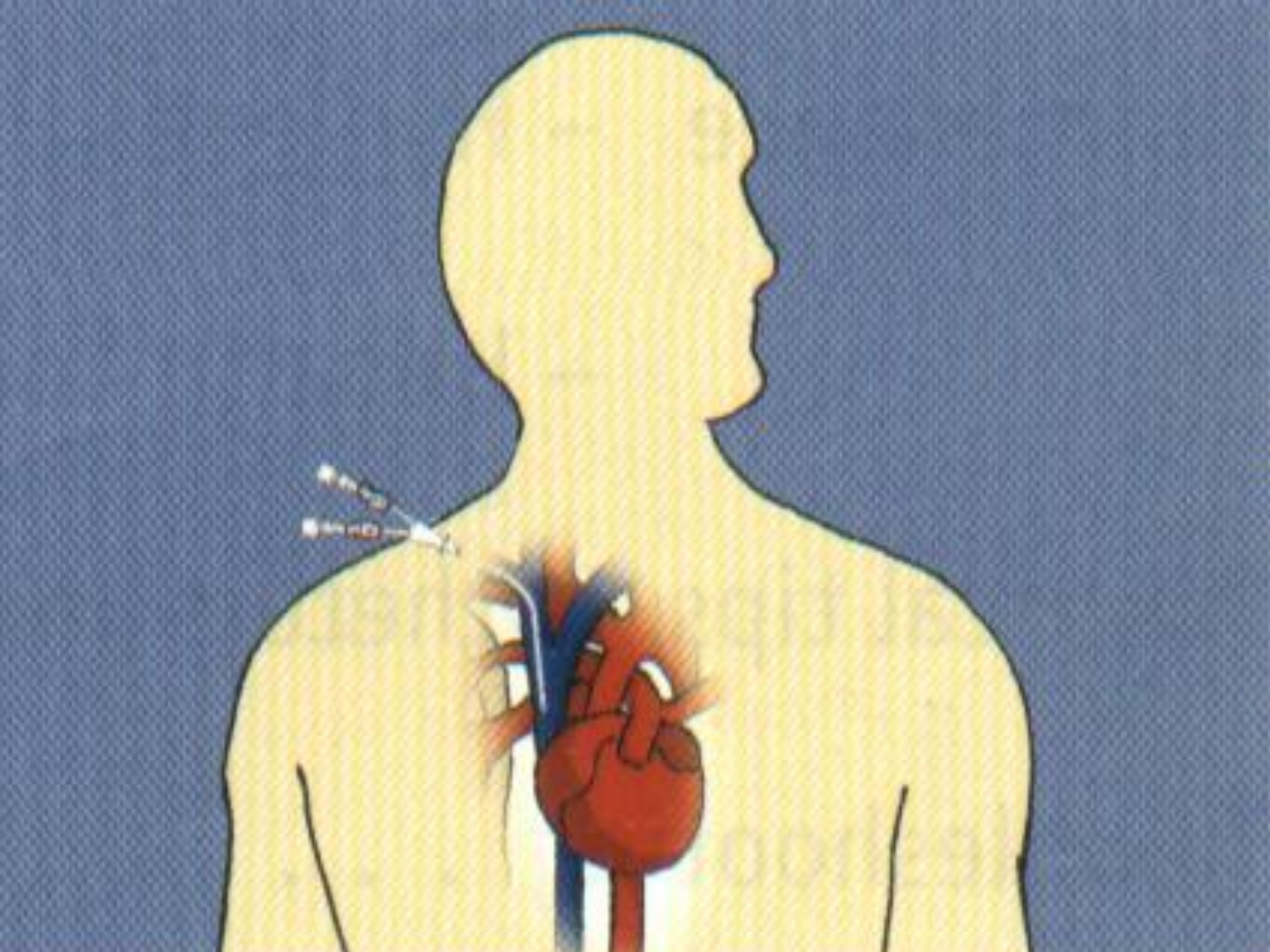


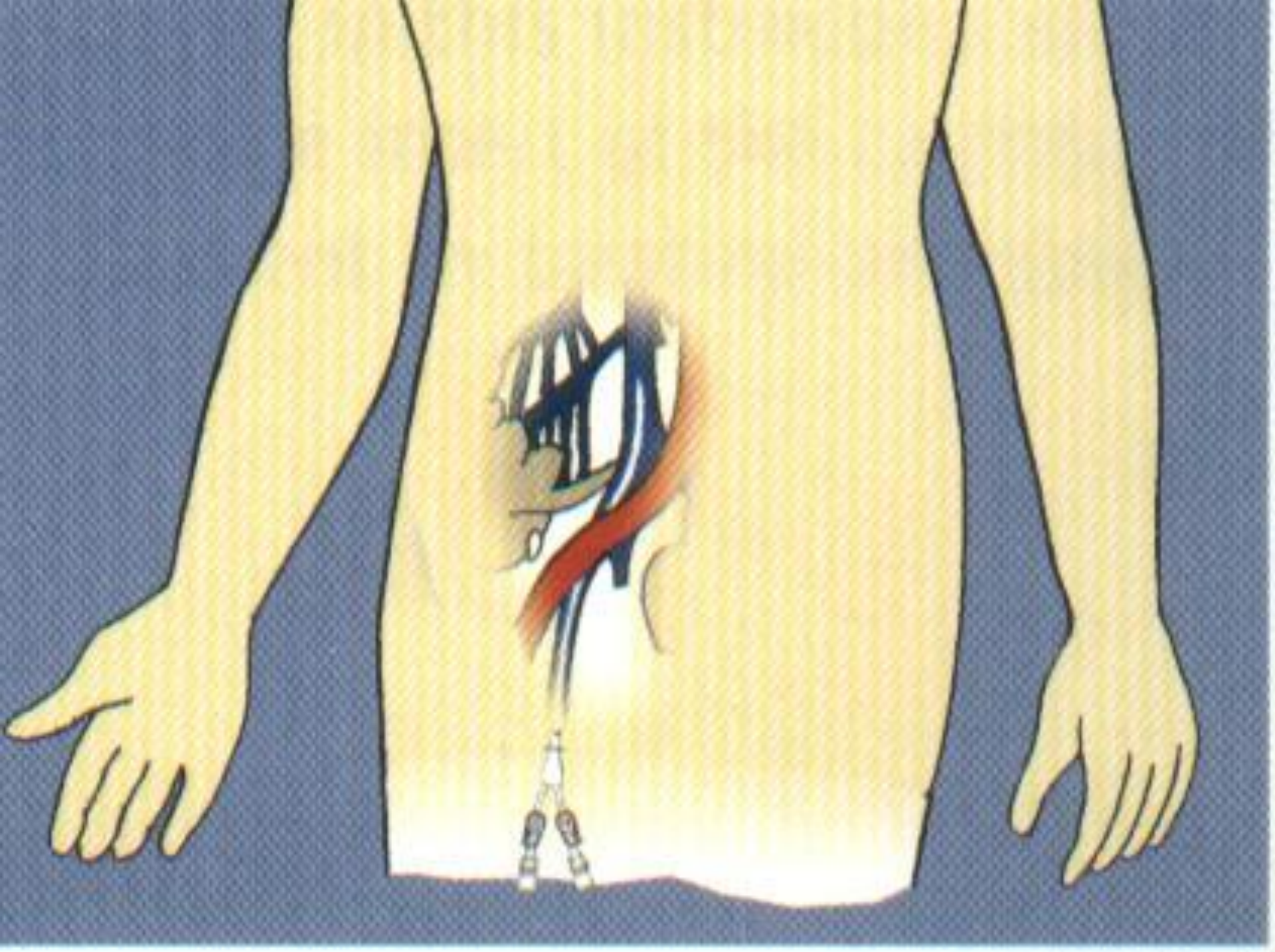
Vascular access

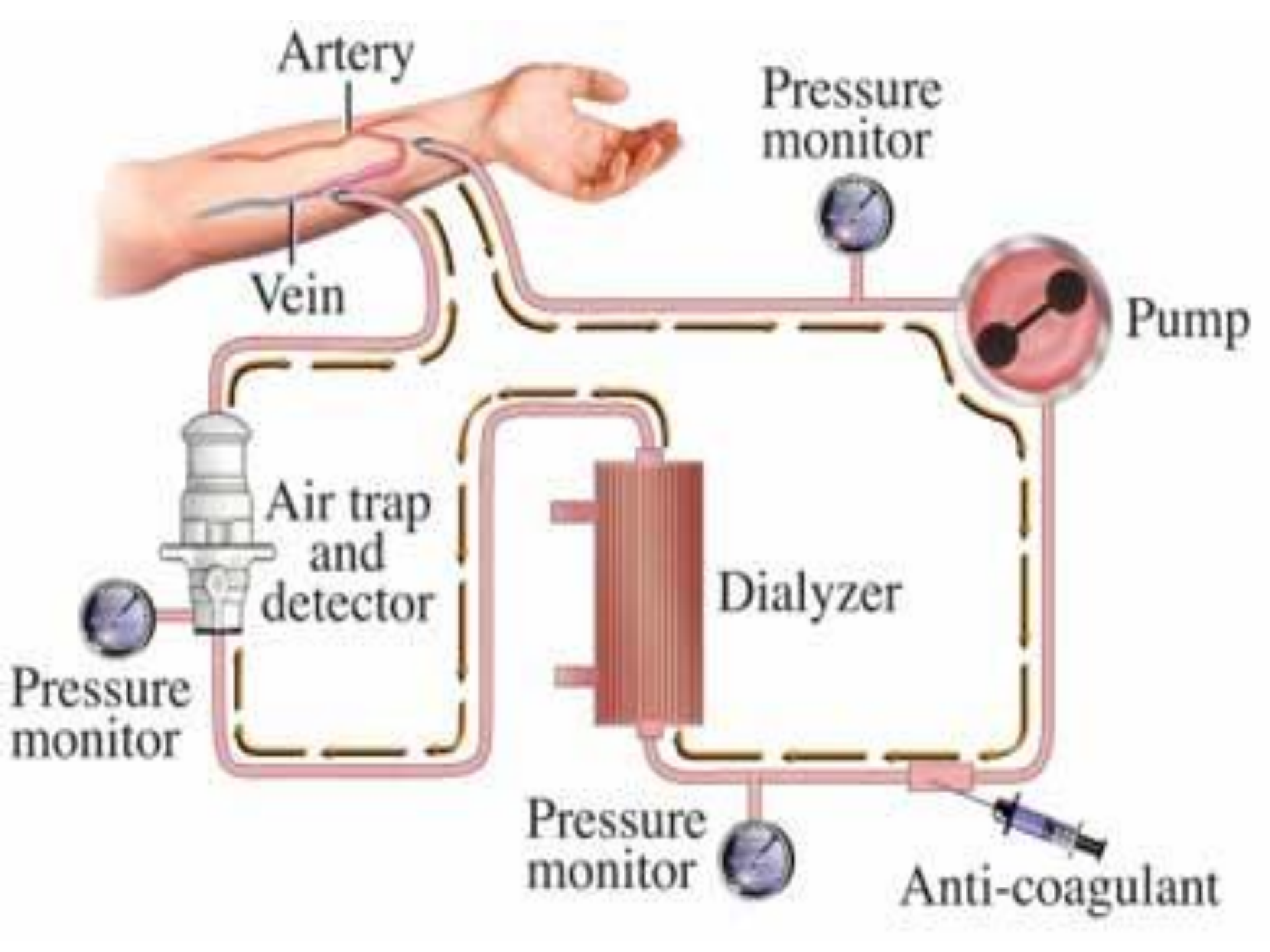


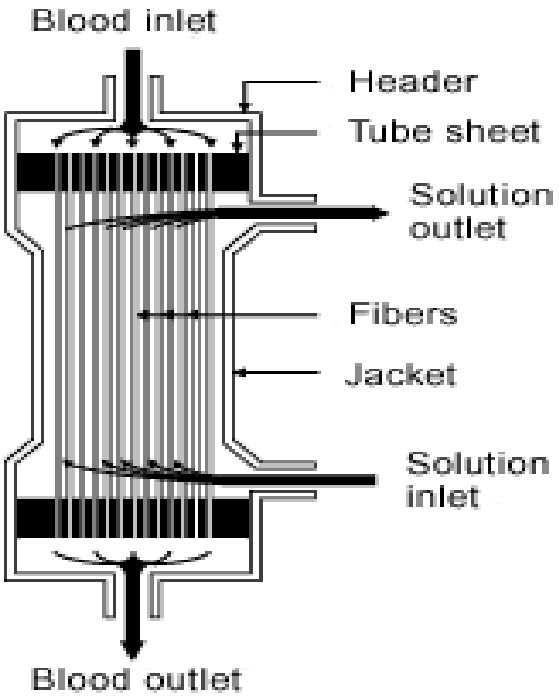

1
2
3
4

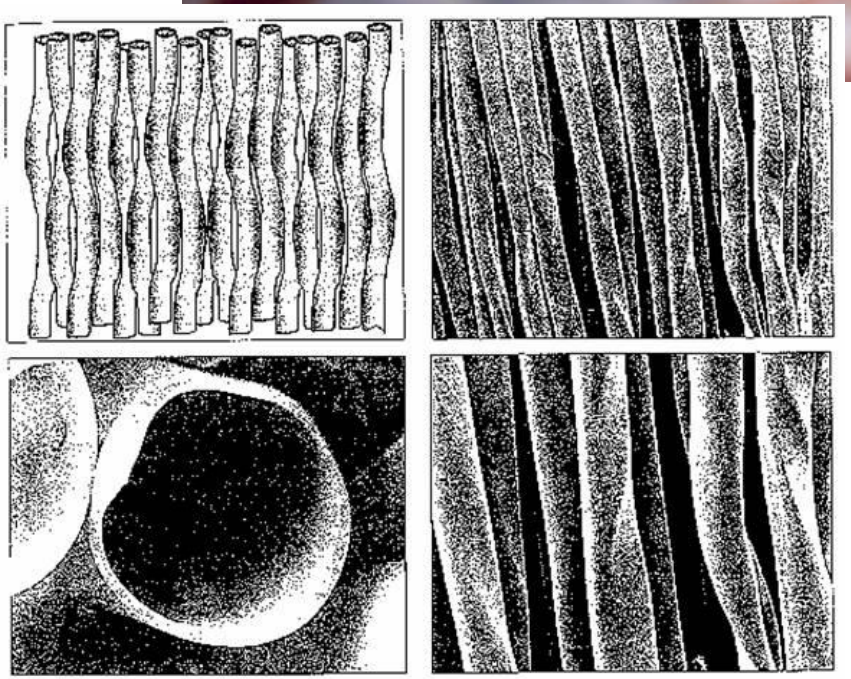




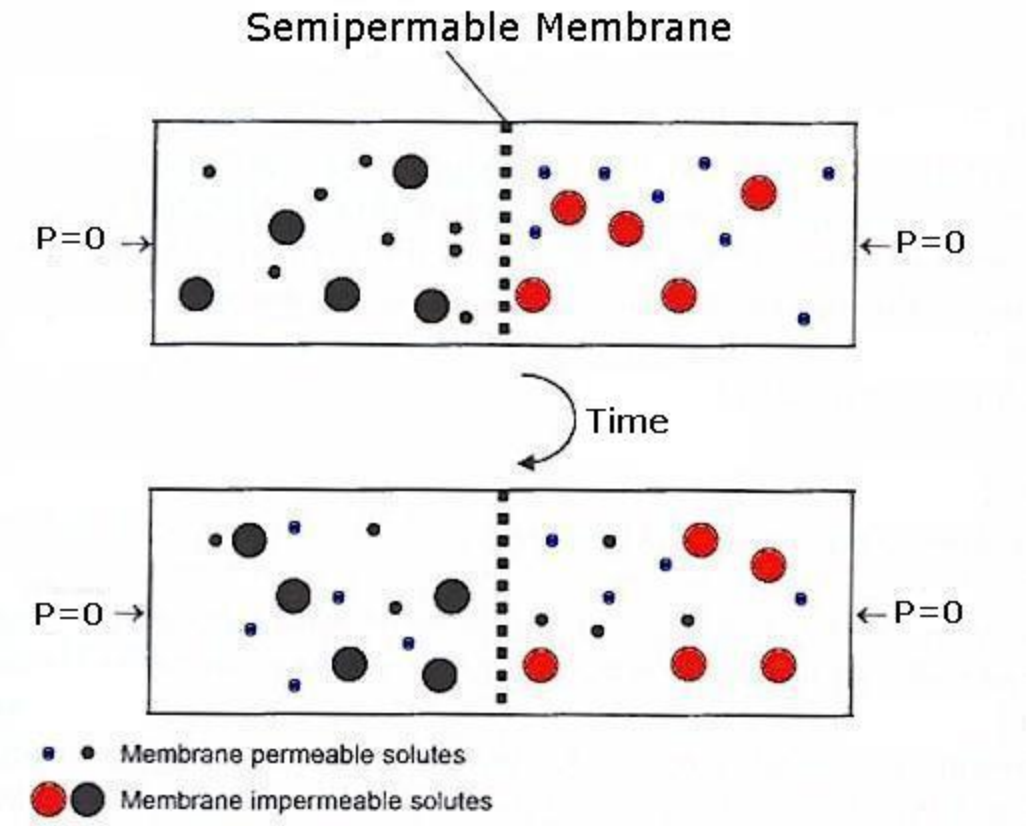



Artery
Vein
Pressure monitor
Pump
Air trap and detector
Dialyzer
Pressure monitor
Pressure monitor
Anti-coagulant

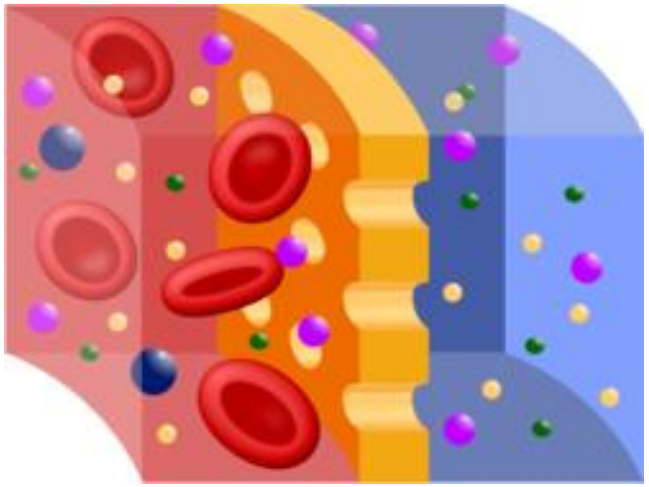

Blood inlet
Header
Tube sheet
Solution outlet
Fibers
Jacket
Solution inlet
Blood outlet



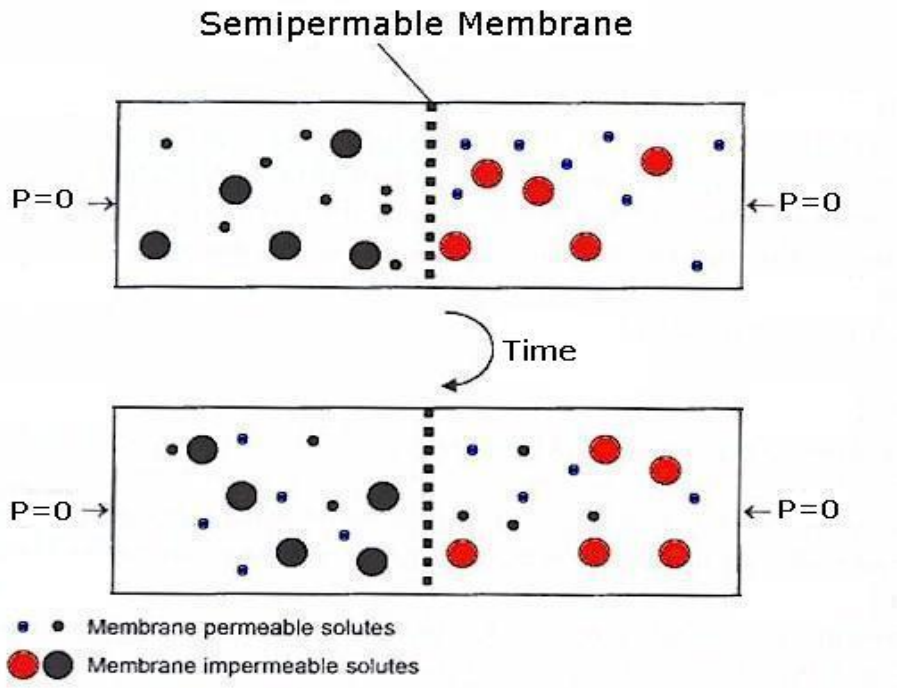
DIFFUSION


Semipermable Membrane
P=0
P=0
Time
P=0
P=0
Membrane permeable solutes
Membrane impermeable solutes

DIFFUSION



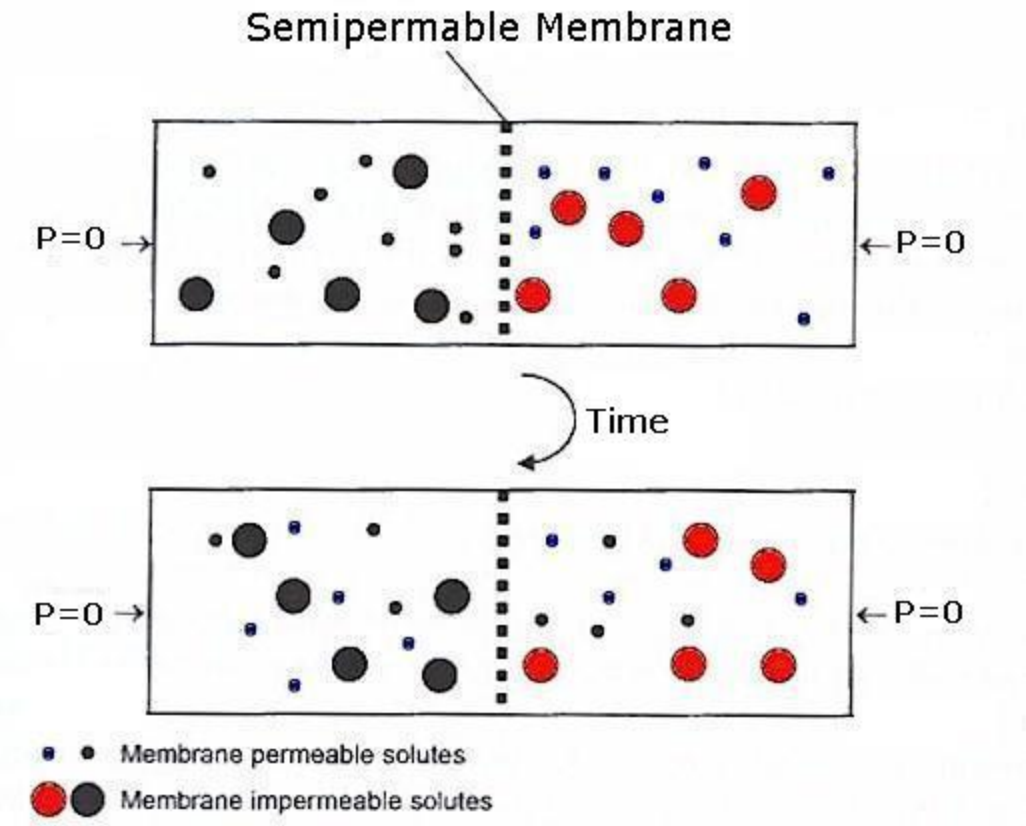
DIFFUSION



The rate of movement will depend on:

- The concentration gradient
- Membrane permeability
- Membrane Surface area
- Blood proteins
- The size of the solute

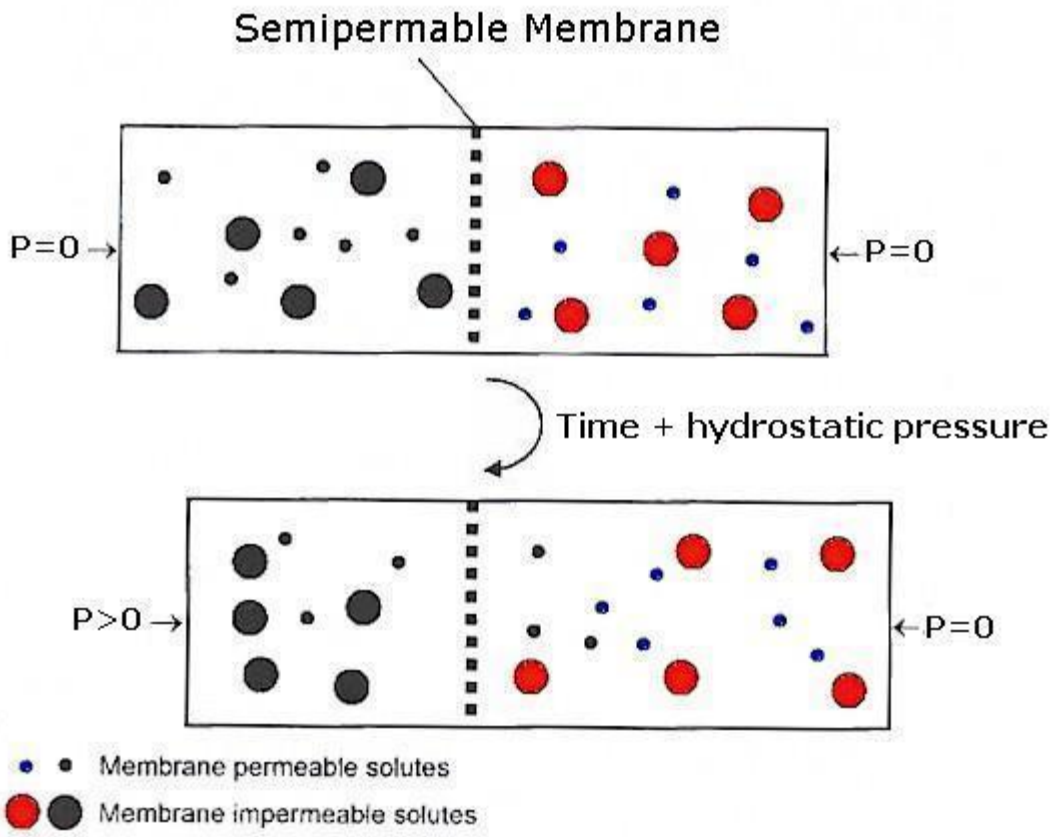
DIFFUSION

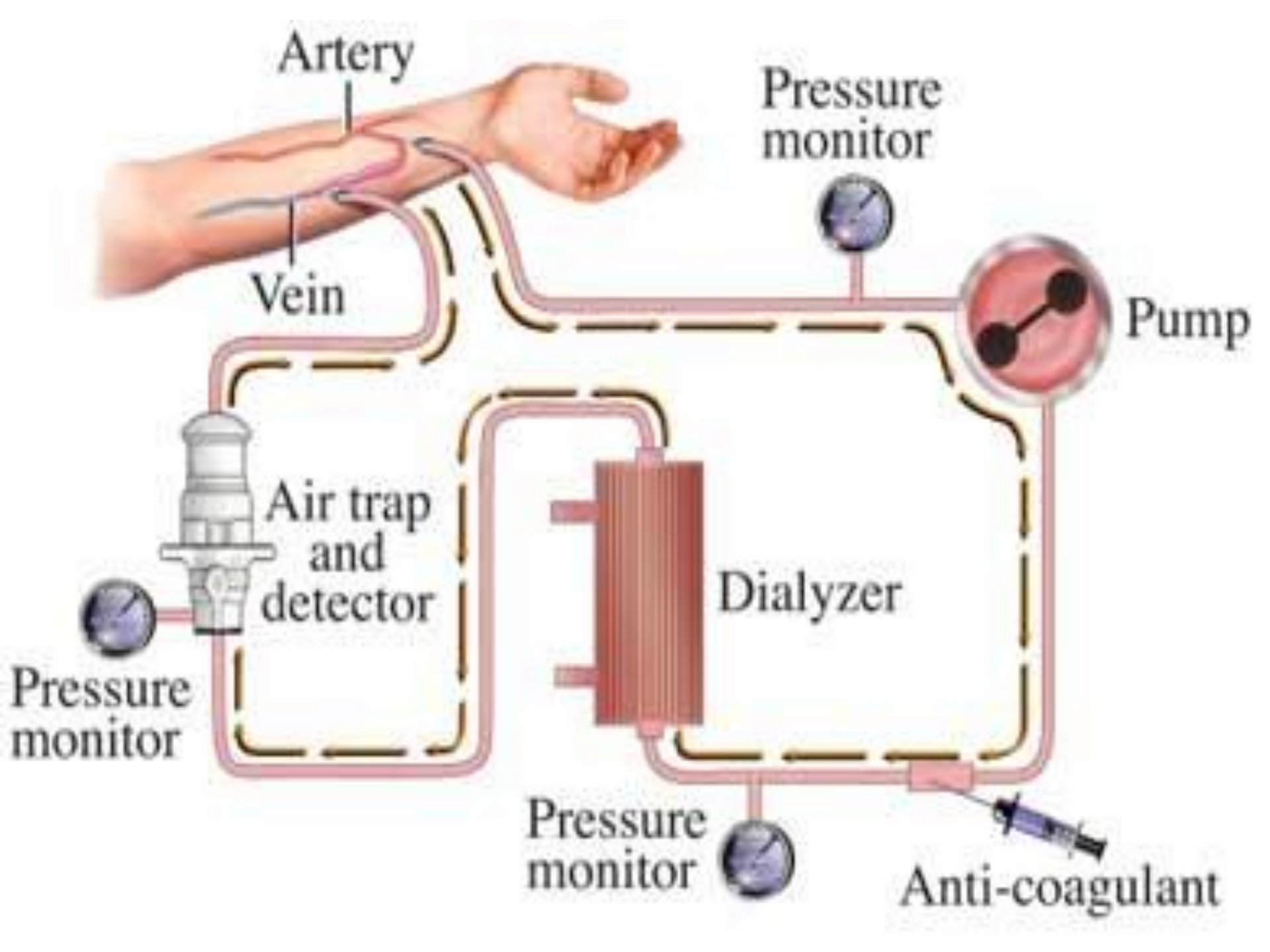


EQUILIBRIUM

ULTRAFILTRATION

HYDROSTATIC




Artery
Vein
Pressure monitor
Pump
Air trap and detector
Dialyzer
Pressure monitor
Pressure monitor
Anti-coagulant

Complications

(I) Common complications

(A) Hypotension:

This is the commonest complication and may be due to:

- High ultrafiltration rate
- Dialysis solution sodium level is too low
- Acetate-containing dialysis solution
- Dialysis solution is too warm
- Food ingestion (splanchnic vasodilatation)
- Autonomic neuropathy (e.g. diabetic patients)
- Diastolic dysfunction
- hemorrhage - Septicemia
- Arrhythmia - Dialyzer reaction

(B) Muscle Cramps.

(C) Nausea and Vomiting.

(D) Headache.

(E) Chest pain and back pain.

(F) Itching.

(G) Fever and chills.

(II) Less Common Complications

(A) Disequilibrium Syndrome:

Definition:

- A set of systemic and neurologic symptoms which are often associated with characteristic EEG findings that can occur either during or soon after dialysis.
- Early manifestations include headache, nausea, vomiting, convulsions and may be coma.
- In severe cases, death can occur if not treated properly.

(B) Dialyzer reactions:

Type A (anaphylactic type):

The manifestations of this type may be mild in the form of itching, cough, urticaria, sneezing, coryza or watery eyes; or may be severe in the form of dyspnea, chest tightness, cardiac arrest or even death.

Treatment:

- Stop dialysis immediately
- Antihistaminics
- Steroids

Type B (Non specific type):

The patients may complain of back pain or chest pain.

Etiology:

Complement activation

Treatment:

No specific treatment

(C) Arrhythmia

(D) Cardiac tamponade:

- Unexpected or recurrent hypotension during dialysis may be a sign of pericardial effusion or impending tamponade.

(E) Intracranial bleeding:

- Underlying vascular disease and hypertension combined with heparin administration can sometimes result in intracarnial bleeding.

(F) Seizures: This occur more often in children

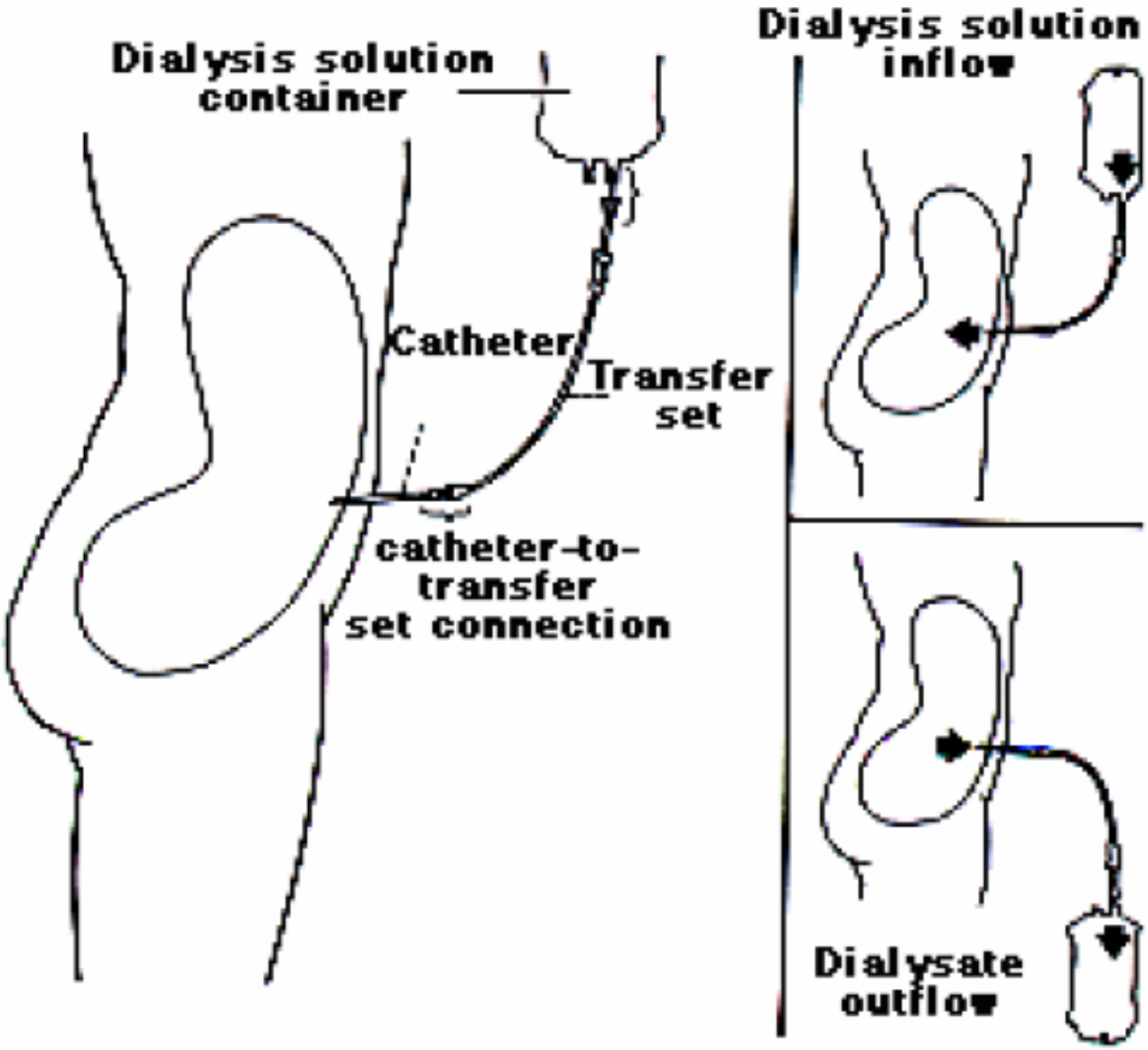
(G) Hemolysis

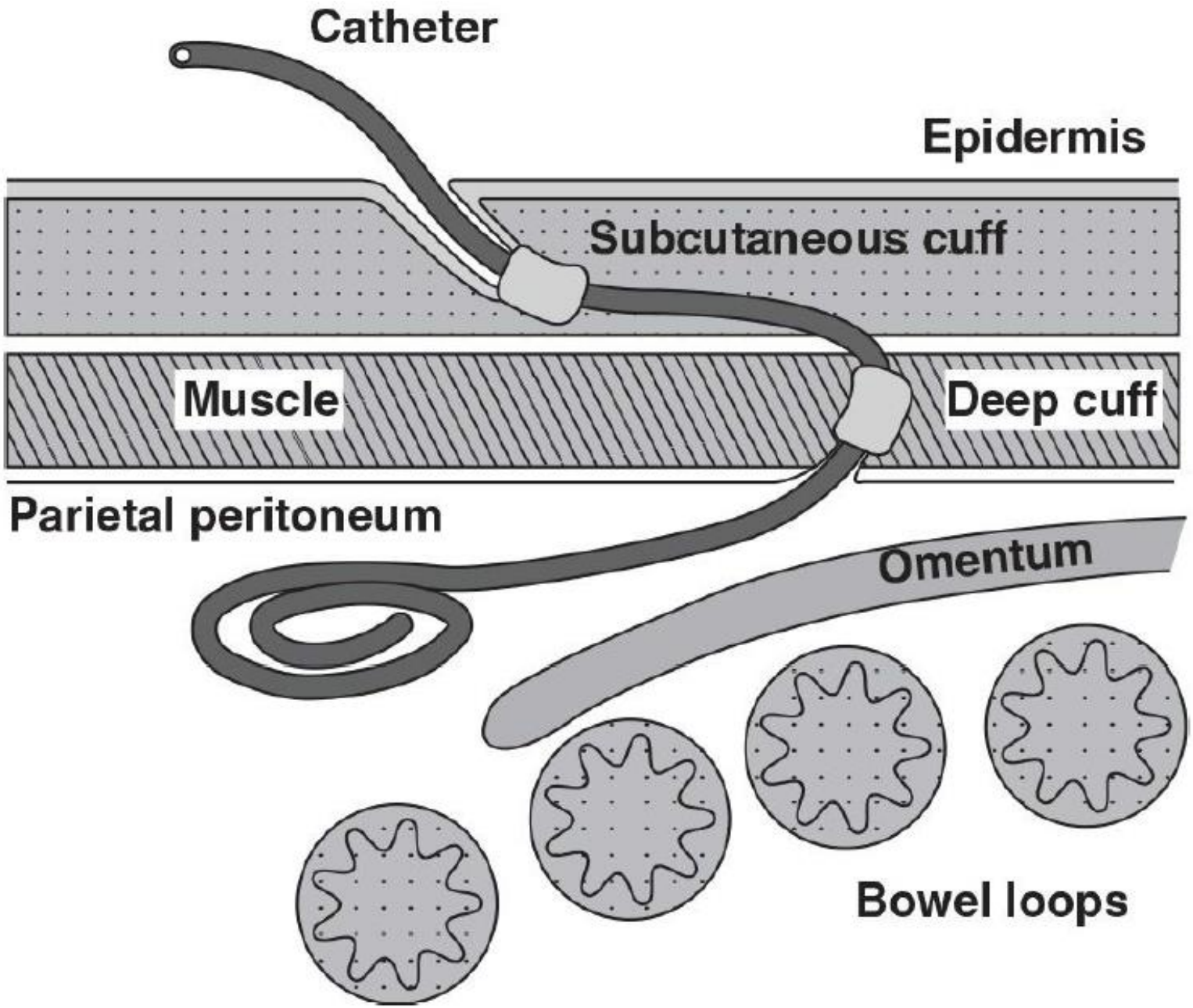
(H) Air embolism:

- It is a potential catastrophe that can lead to death if not quickly detected and treated.

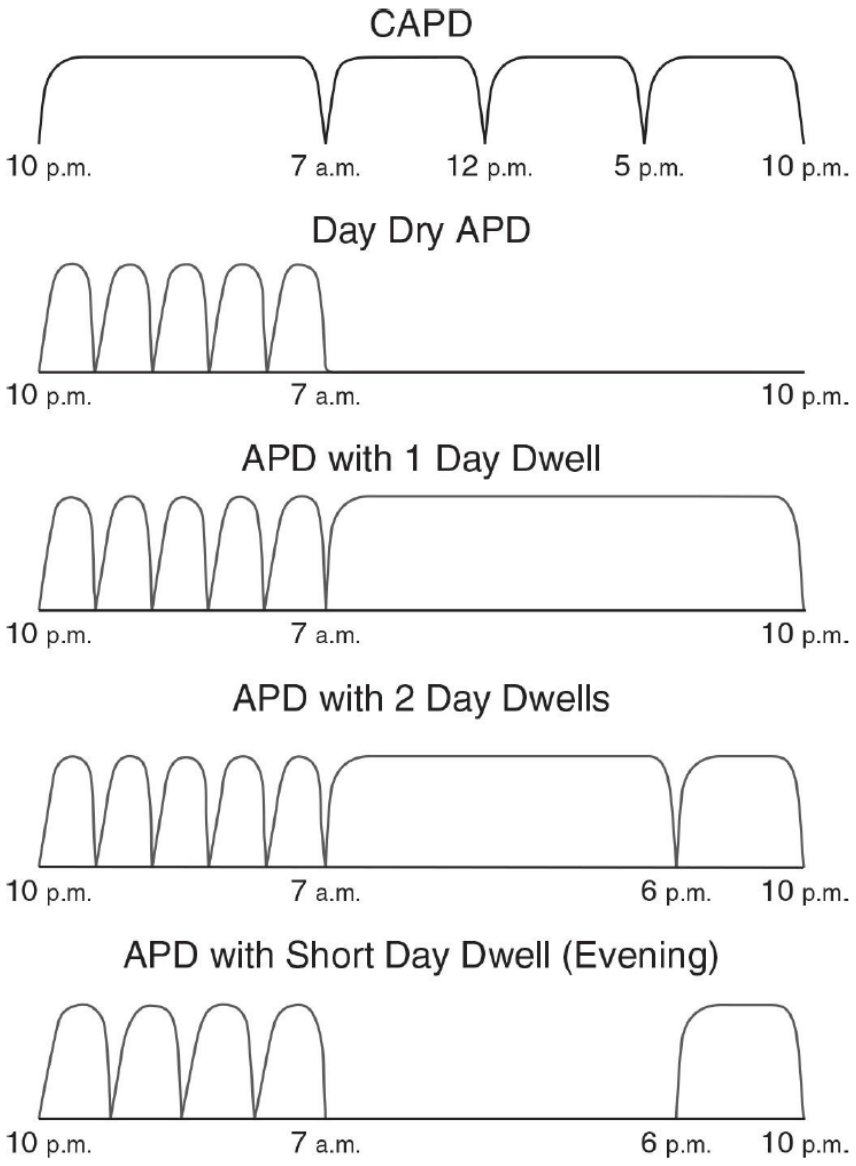
Peritoneal dialysis

- It is the movement of solutes and water from patient's blood across a semipermeable membrane (which is the peritoneal membrane) to the dialysis solution (dialysate).
- This is carried out via a peritoneal catheter which is inserted into the peritoneal cavity for infusion of the dialysate which is left to dwell then; drained out via the catheter


Dialysis solution container
Catheter
Transfer set
catheter-to-transfer set connection
Dialysis solution inflow
Dialysate outflow


Catheter
Epidermis
Subcutaneous cuff
Muscle
Deep cuff
Parietal peritoneum
Omentum
Bowel loops

Types


CAPD
10 p.m.
7 a.m.
12 p.m.
5 p.m.
10 p.m.
Day Dry APD
10 p.m.
7 a.m.
10 p.m.
APD with 1 Day Dwell
10 p.m.
7 a.m.
10 p.m.
APD with 2 Day Dwells
10 p.m.
7 a.m.
6 p.m.
10 p.m.
APD with Short Day Dwell (Evening)
10 p.m.
7 a.m.
6 p.m.
10 p.m.

Indications

1- Infant and very young children

2- End stage renal failure patients with cardiovascular or hemodynamic instability.

3- Hemodialysis patients with vascular access failure (especially diabetics)

4- Patients for whom vascular access can not be created (especially diabetics)

5- High risk of anticoagulants

6- Patients who desire greater freedom to travel

Contraindications

Absolute

1- Extensive peritoneal fibrosis

2- Pleuroperitoneal leak

Relative

1- Presence of colostomy or nephrostomy

2- Recent thoracic or abdominal surgery

3- Inguinal or abdominal hernia

4- Blindness

5 - Mental retardation

6- Poor motivation and compliance

Complications

A. Mechanical:

- Pain during inflow owing to hot dialysate or rapid jetting
- Pain during outflow due to ball-valve effect
- Outflow failure due to constipation, obstruction or malposition of the catheter
- Pericatheter leakage because of very early usage of the catheter
- Scrotal edema

B. Pulmonary:

- Atelectasis
- Hydrothorax
- Restricted chest movement

C. Metabolic:

- Hyperglycemia
- Hyperlipidemia
- Protein depletion
- Obesity

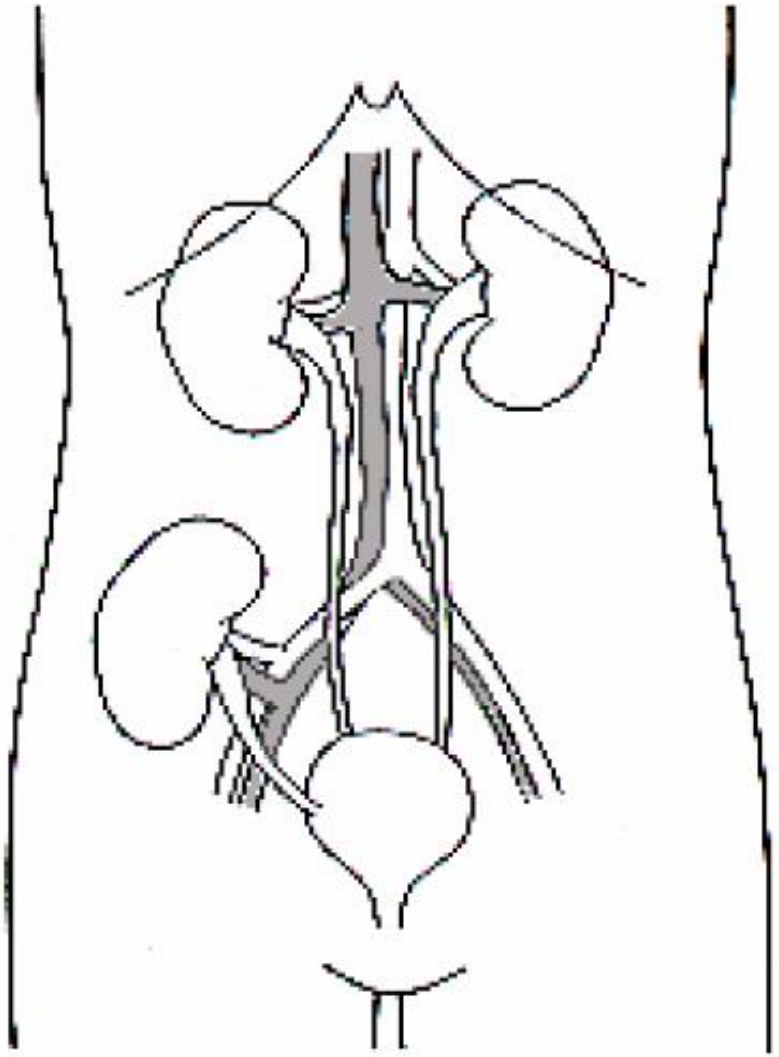
D. Infectious and inflammatory

- Peritonitis
- Exit site infection
- Tunnel infection

- Hemodialysis
  - Better clearance
  - Short time for treatment
  - Have to leave home 3x/wk
  - Can cause disequilibrium syndrome, muscle cramps, hemorrhage
  - Restricted diet

- Peritoneal dialysis
  - Easy access
  - Fewer hemodynamic complications
  - Infections and adhesions can occur
  - Less effective
  - Protein loss and peritonitis
  - Uses intra-abdominal catheter

Kidney transplantation



Indications

- Patients with ESRD requiring renal replacement therapy.

Contraindications

1- Patient refusal

2- Psychosis

3- Age more than 60 years (relative)

4- Recurrent disease, if the original kidney disease that caused renal failure can recur in the transplanted kidney and destroy it e.g. oxalosis.

5- Systemic disease:

- Severe respiratory disease e.g. C.O.P.D.
- Severe cardiovascular disease e.g. severe left ventricular failure
- Severe hepatic disease e.g. liver cell failure
- Central nervous system e.g. Recurrent cerebral hemorrhage
- Active peptic ulceration
- Malignancy
- Active infection

6- Unrepairable urologic abnormalities.

Complications

1- Rejections:

- **Hyperacute:** usually occurs Immediately postoperative.
- **Acute:** Usually occurs days or weeks to months postoperatively
- **Chronic:** Usually occurs months to years postoperatively.

2- Complications of immunosuppression therapy:

a. General complications:

1. Infection
2. Increased incidence of malignancy

b. Complications due to individual drugs:

1. Steroids: hypertension, D.M., atherosclerosis, Bone disease, GIT bleeding and cataract.

2. Azathioprine: Bone marrow depression and hepatic dysfunction

3- Cyclosporine: Nephrotoxicity, hepatotoxicity, hypertension and D.M.

3- Recurrence of the original kidney disease into the graft (e.g. FSGS, MPGN)


Thank
You!