17/MHS01/277

OTUONYE GIFT CHARLES

PHYS 303

ASSIGNMENT

QUESTION: 1. Discuss the pathophysiological process involves in renal failure?

2. With the aid of suitable diagrams discuss the types of dialysis you know?

ANSWER

QUESTION 1

Renal failure refers to the deterioration of renal functions resulting in a decline in glomerular filtration rate (GFR) and rise in urea and non-nitrogenous substances in the blood. It is of two types:

- Acute renal failure(ARF) - It refers to the sudden decline in glomerular filtration rate over a period of days or weeks associated with a rapid rise in blood urea.
- Chronic renal failure(CRF) - It refers to a slow, insidious, irreversible deterioration of renal functions resulting in the development of clinical syndrome of uraemia, manifested by excretory, metabolic, neurological, haematological and endocrinal abnormalities.

Common causes of acute renal failure (ARF) can be grouped as:

1. Prerenal causes: include Reduced blood supply to the kidneys. Normally, kidneys receive about 20–25% of the cardiac output (1100 ml/min). Decreased renal blood flow is usually accompanied by decreased glomerular filtration rate and reduced urinary output. When blood flow is reduced below the basal requirements (i.e. 20–25% less than normal renal blood flow), renal ischemia occurs causing damage to renal cells, particularly tubular epithelial cells. The common causes of reduced blood flow to kidney are severe haemorrhage, shock, severe burns, hypovolaemia, septicaemia, cardiac failure and so on.

2. Intrarenal causes: include acute glomerulonephritis and acute tubular necrosis

3. Obstructive causes: include urinary tract obstruction at any site. Postrenal or obstructive renal failure occurs due to abnormalities of lower urinary tract which partially or completely blocks urinary flow (though renal blood flow is normal). If the urine output of only one kidney is blocked, no major changes occur in body fluids composition because the contralateral kidney undergoes compensation. The causes of postrenal acute renal failure include:

i. Bilateral obstruction of ureters, or of renal pelvis, by large stones or blood clots

ii. Bladder or urethral obstruction

Physiological effects of acute renal failure include:

- Retention of salt and water, waste metabolites and electrolytes (rise in creatinine and urea) in blood and extracellular fluid can lead to oedema and hypertension.
- Excessive retention of potassium (hyperkalaemia) is a serious threat to a patient with acute renal failure.
- Kidneys are unable to excrete hydrogen ions resulting in metabolic acidosis and that itself is a fatal condition and also aggravates hyperkalaemia.
- In severe cases of acute renal failure, oliguria or complete anuria occurs and the patient may die unless kidney functions are restored.

Characteristic features of Acute renal failure include:

- No history of pre-existing renal disease
- Presence of oliguria or anuria
- Rapid rise in blood urea and creatinine levels
- High urine osmolality (>400 mOsm/kg H_2O).

Chronic renal failure, like acute renal failure, also occurs in a wide variety of diseases, but the end result is reduction of functional nephrons and deterioration of the kidney function to the point, where the patient must be placed on dialysis treatment or transplanted with a functional kidney for survival. This condition is referred as end-stage renal disease (ESRD). The exact mechanism of this stage is not well understood, but a slowly progressing vicious cycle due to renal adaptive changes may be responsible.

Common causes which lead on to slow, progressive nephron loss and ultimately chronic renal failure can be grouped as under:

1. Congenital disorders, e.g. polycystic kidney.

2. Vascular diseases of kidney, renal hypertension. Injury to renal vasculature can lead to renal ischemia. The most common cause of renal vascular injury is atherosclerosis. Atherosclerosis of the larger renal arteries leads to hypertension and involvement of smaller arteries (interlobular arteries and efferent arterioles) results in thickening of vessel walls due to deposits of fibrinoid tissue (nephrosclerosis), eventually leading to constriction (ischemic injury).

3. Glomerular diseases, e.g. proliferative glomerulonephritis and diabetic nephropathy. Chronic glomerulonephritis: injury to glomeruli can be caused by several diseases. In most cases, it begins with accumulation of antigen–antibody complexes in the glomerular membrane and ultimately glomeruli are replaced by fibrous tissue, therefore unable to filter the fluid. Therefore, glomerular capillary filtration coefficient gets markedly reduced.

4. Tubulointerstitial disease, e.g. chronic pyelonephritis and analgesic nephropathy. These diseases are referred to as interstitial nephritis. Injury to renal interstitium can be caused by bacterial infection (called as pyelonephritis) or as a result of vascular, glomerular and tubular damage by poison and toxic drugs.

5. Obstructive renal diseases, e.g. benign enlargement of prostate, renal calculi and ureteral constriction.

QUESTION2

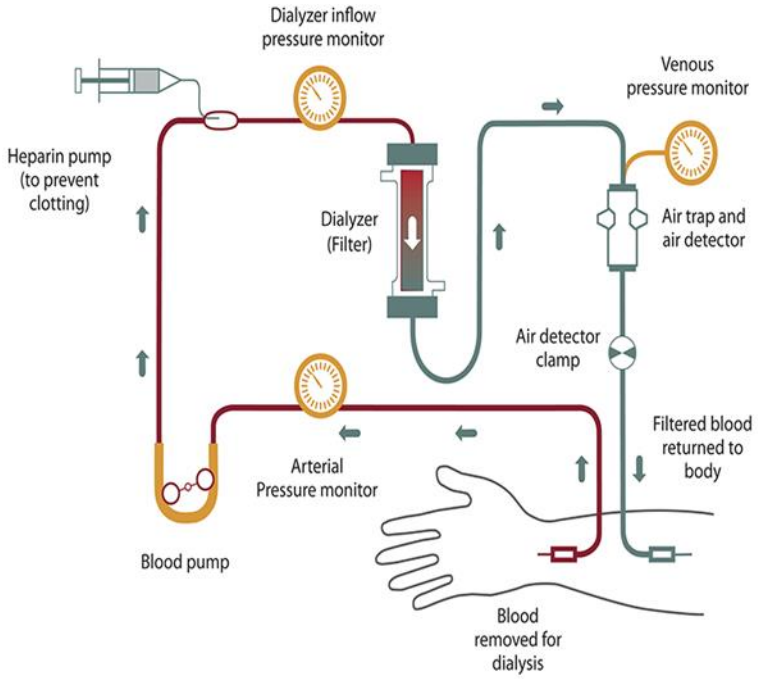
A) HEMODIALYSIS

In hemodialysis, an artificial kidney (hemodialyzer) is used to remove waste and extra chemicals and fluid from your blood. To get your blood into the artificial kidney, the doctor needs to make an access (entrance) into your blood vessels. This is done by minor surgery to your arm or leg.

Sometimes, an access is made by joining an artery to a vein under your skin to make a bigger blood vessel called a fistula.

However, if your blood vessels are not adequate for a fistula, the doctor may use a soft plastic tube to join an artery and a vein under your skin. This is called a graft.

Occasionally, an access is made by means of a narrow plastic tube, called a catheter, which is inserted into a large vein in your neck. This type of access may be temporary, but is sometimes used for long-term treatment.

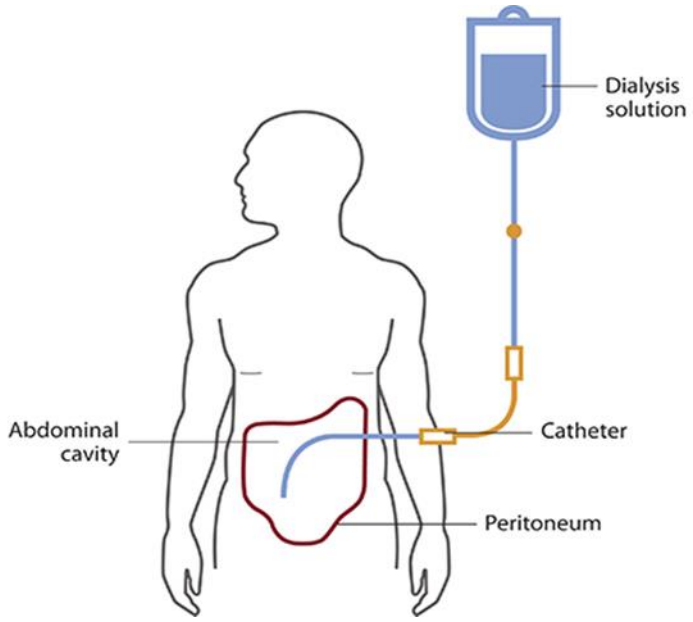


Risks associated with hemodialysis

1. low blood pressure
2. anemia, or not having enough red blood cells
3. muscle cramping
4. difficulty sleeping
5. itching
6. high blood potassium levels
7. pericarditis, an inflammation of the membrane around the heart
8. sepsis
9. bacteremia, or a bloodstream infection
10. irregular heartbeat
11. sudden cardiac death, the leading cause of death in people undergoing dialysis

B) PERITONEAL DIALYSIS

In this type of dialysis, your blood is cleaned inside your body. The doctor will do surgery to place a plastic tube called a catheter into your abdomen (belly) to make an access. During the treatment, your abdominal area (called the peritoneal cavity) is slowly filled with dialysate through the catheter. The blood stays in the arteries and veins that line your peritoneal cavity. Extra fluid and waste products are drawn out of your blood and into the dialysate.



Risks associated with peritoneal dialysis

Peritoneal dialysis is associated with an increased risk for infections in or around the catheter site in the abdominal cavity. For example, after catheter implantation, a person can experience peritonitis. Peritonitis is an infection of the membrane lining the abdominal wall.

Other risks include:

1. abdominal muscle weakening
2. high blood sugar due to the dextrose in the dialysate
3. weight gain
4. hernia
5. fever
6. stomach pain

There are numerous different types of peritoneal dialysis. The main ones are:

1. Continuous ambulatory peritoneal dialysis (CAPD). In CAPD, your abdomen is filled and drained multiple times each day. This method doesn't require a machine and must be performed while awake.
2. Continuous cycling peritoneal dialysis (CCPD). CCPD uses a machine to cycle the fluid in and out of your abdomen. It's usually done at night while you sleep.
3. Intermittent peritoneal dialysis (IPD). This treatment is usually performed in the hospital, though it may be performed at home. It uses the same machine as CCPD, but the process takes longer.

Continuous renal replacement therapy (CRRT)

This therapy is used primarily in the intensive care unit for people with acute kidney failure. It's also known as hemofiltration. A machine passes the blood through tubing. A filter then removes waste products and water. The blood is returned to the body, along with replacement fluid. This procedure is performed 12 to 24 hours a day, generally every day.

Risks associated with CRRT

The risks associated with CRRT include:

1. Infection
2. Hypothermia
3. low blood pressure
4. electrolyte disturbances
5. bleeding
6. delayed renal recovery
7. weakening of bones
8. anaphylaxis