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DEPT: MEDICINE & SURGERY

ASSIGNMENT

1. Discuss the pathophysiological process involved in renal failure
2. With the aid of suitable diagrams discuss the types of dialysis you know

ANSWER 1

PATHOLOGICAL PROCESS INVOLVED IN RENAL FAILURE

Renal failure occurs when the kidney lose the ability to sufficiently filter out waste and balance fluids in the body.

There are 2 common types of renal failure

1. Acute renal failure
2. Chronic renal failure

Acute Renal Failure

Acute renal failure occurs when there is a sudden stop in kidney function. The kidney may eventually recover and return close to its optimal performance.

Causes of acute failure

It may result due to many reasons. Causes of acute renal failure can be classified into 3 groups

- a) Prerenal acute renal failure: occurs when there is a sudden reduction in blood flow to the kidney. This can be a consequence of heart failure with reduced cardiac output and low blood pressure or conditions associated with

diminished blood volume and low blood pressure, such as severe hemorrhage.

- b) Intrarenal: results from abnormalities within the kidney itself, including those that affect the blood vessels, glomeruli, or tubules. Intrarenal renal failure is usually classified according to the site of the kidney which is damaged;
- Conditions that injure the glomerular capillaries or other small renal vessels eg. Vasculitis (polyarteritis nodosa), Cholesterol emboli, Malignant hypertension, Acute glomerulonephritis
 - Conditions that damage the renal tubular epithelium e.g Acute tubular necrosis due to ischemia, Acute tubular necrosis due to toxins (heavy metals, ethylene glycol, insecticides, poison mushrooms, carbon tetrachloride)
 - Conditions that cause damage to the renal interstitium e.g Acute pyelonephritis, Acute allergic interstitial nephritis.

The most common causes of intrarenal acute renal failure are acute tubular necrosis, acute glomerulonephritis, and acute interstitial nephritis.

- c) Postrenal: resulting from obstruction of the urinary collecting system anywhere from the calyces to the outflow from the bladder. The most common causes of obstruction of the urinary tract outside the kidney are kidney stones, caused by precipitation of calcium, urate, or cystine.

Chronic Renal Failure

Chronic renal failure is due to a gradual and progressive failure of renal functions over time (months or years). It is irreversible, and in advanced stages, dangerous level of wastes and fluids back up in the body. Chronic renal failure results due to progressive loss of a large number of nephrons. Due to the kidney compensatory mechanism, serious clinical effect of chronic renal failure is not noticed until 70-75 percent of functional nephrons are lost. There are many causes of chronic renal failure which all result in loss of functional nephrons.

Some causes of chronic renal failure include

- **Metabolic disorders;** Diabetes mellitus, Obesity, Amyloidosis
- **Hypertension Renal vascular disorders;** Atherosclerosis, Nephrosclerosis-hypertension

- **Immunologic disorders;** Glomerulonephritis, Polyarteritis nodosa, Lupus erythematosus
- **Infections;** Pyelonephritis ,Tuberculosis
- **Primary tubular disorders;** Nephrotoxins (analgesics, heavy metals)
- **Urinary tract obstruction;** Renal calculi, Hypertrophy of prostate, Urethral constriction
- **Congenital disorders;** Polycystic disease, Congenital absence of kidney tissue (renal hypoplasia)

ANSWER 2

TYPES OF DIALYSIS

Dialysis is the process of removing waste products (excess water, solutes, and toxins) from the blood in patients who do not have functional kidneys. It is known as renal replacement therapy.

There are three main forms of dialysis

1. Intermittent hemodialysis
2. Peritoneal dialysis
3. Continuous renal replacement.

INTERMITTENT HEMODIALYSIS

This is the most common type of dialysis. It uses an artificial kidney called the hemodialyzer which filters water solutes and toxins in blood. The blood is circulated through the hemodialyzer for filtration and returned to the body of the patient.

In order for a hemodialyzer to be used there must be an access point for blood to flow through to it. There are 3 methods used to do this;

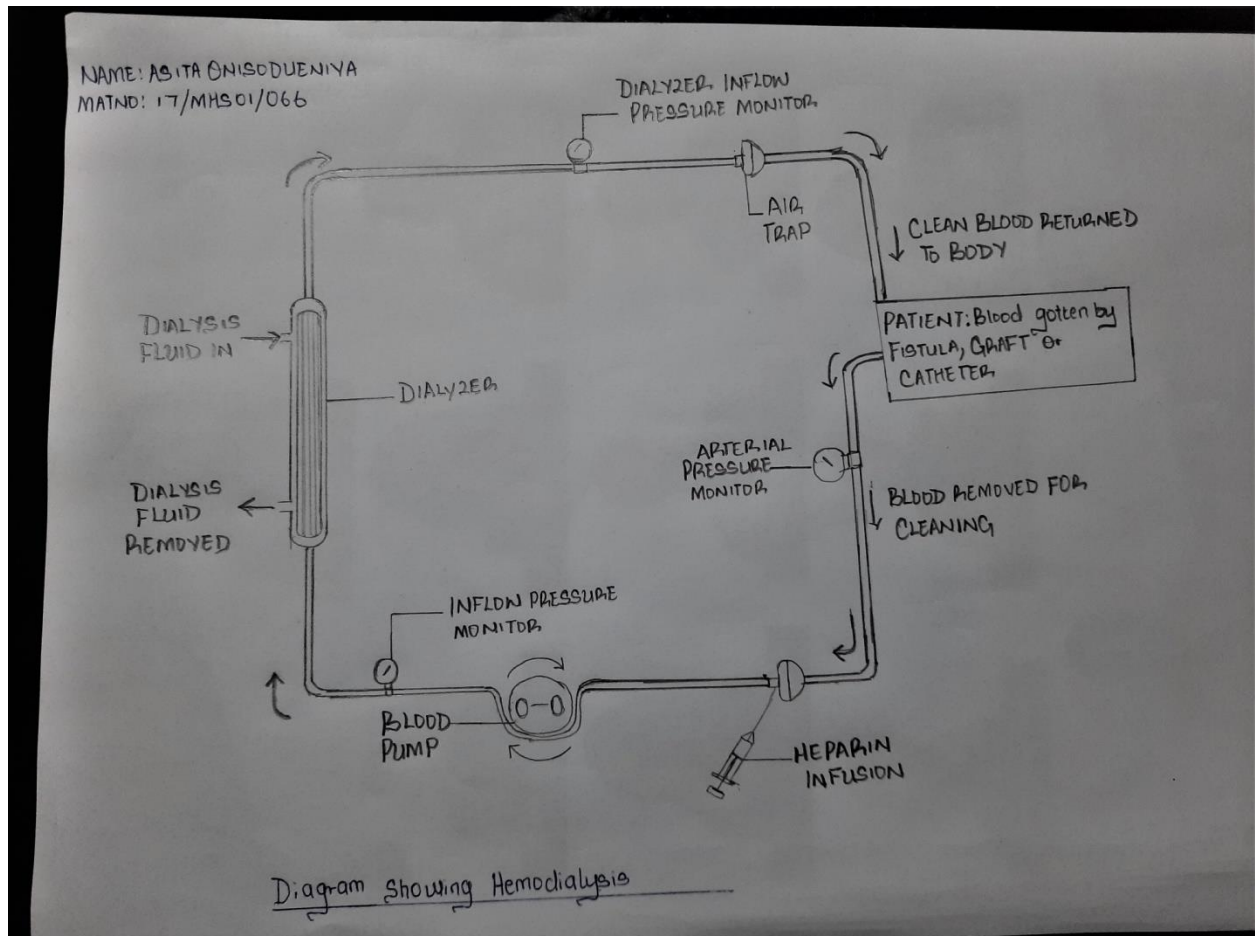
- Arteriovenous fistula
- Arteriovenous graft
- Catheter (central venous catheter)

Arteriovenous fistula; a vein and an artery under the skin in the arm are joined together. It takes about 6 weeks to heal, this it is used for hemodialysis.

Arteriovenous graft; an artery and vein under the skin are joined using a plastic tube. It heals up after about two weeks then it is used for hemodialysis

Catheter; a catheter (thin tube) is inserted in the body at the vein below the scapula.

The fistula and graft method are used for long term hemodialysis, while the catheter is for immediate purposes.



1DIAGRAM SHOWING HEMODIALYSIS

PERITONEAL DIALYSIS

Peritoneal dialysis makes use of diffusion through the peritoneal membrane to filter blood. A catheter is placed in the peritoneal cavity. The peritoneal membrane is semi-permeable hence allows the passage of fluid. A solution rich in minerals and glucose called dialysate is passed through the catheter into the peritoneal

cavity. The dialysate is left in the peritoneal cavity for a while to absorb waste from the blood then it is removed through a tube. The exchange is repeated several times during the day.

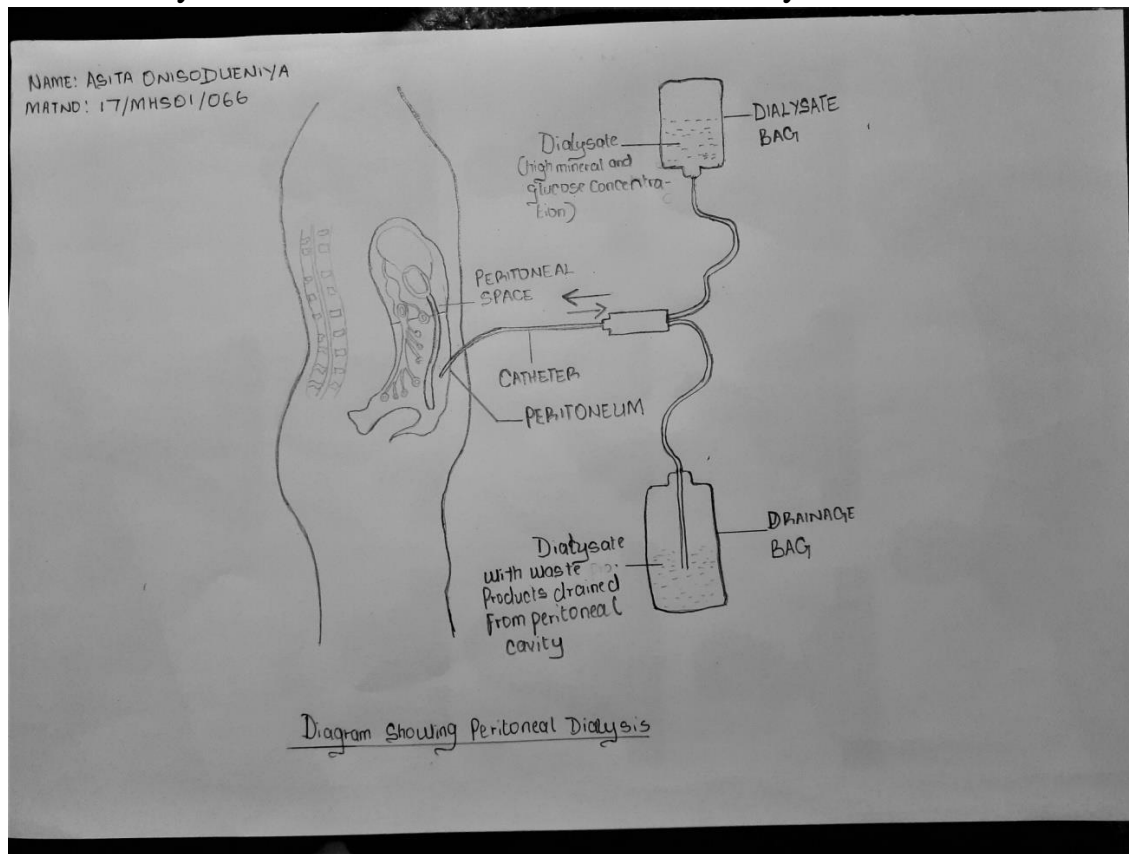
The dialysate has a high concentration of minerals and glucose, hence a concentration gradient is created whereby fluids move through the peritoneal membrane to be absorbed by the dialysate.

Types of peritoneal dialysis are;

- Continuous ambulatory peritoneal dialysis (CAPD)
- Continuous cyclic peritoneal dialysis/ automated peritoneal dialysis (CCPD)
- Intermittent peritoneal dialysis (IPD)

CAPD; it does not require a machine carryout exchange. The patient can do it. The dialysate is left in the peritoneal cavity for about 8 hours and is replaced.

CCPD; dialysis is done with the use of an automated machine. The machine cycles the dialysate in and out of the patient. Generally, peritoneal dialysis takes a longer time to carryout but has the same effect as hemodialysis.



2DIAGRAM SHOWING PERITONEAL DIALYSIS

CONTINUOUS RENAL REPLACEMENT THERAPY

This follows the same procedure as intermittent hemodialysis, the difference is it takes a longer period (about 12-24 hours) and must be done every day. Blood is passed through a tube to a machine which filters it (removes waste products and water). The blood is then returned back to the body along with replacement fluid. The body responds better to it, because the fluid removal is slower. This leads to fewer complications.

There are various risks associated with the various forms of dialysis. These include;

Hemodialysis risks include:

- low blood pressure
- anemia, or not having enough red blood cells
- muscle cramping
- difficulty sleeping
- itching
- high blood potassium levels
- pericarditis, an inflammation of the membrane around the heart
- sepsis
- bacteremia, or a bloodstream infection
- irregular heartbeat
- sudden cardiac death, the leading cause of death in people undergoing dialysis

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:

- abdominal muscle weakening
- high blood sugar due to the dextrose in the dialysate
- weight gain

- hernia
- fever
- stomach pain

The risks associated with CRRT include:

- infection
- hypothermia
- low blood pressure
- electrolyte disturbances
- bleeding
- delayed renal recovery
- weakening of bones
- anaphylaxis