

**ASSIGNMENT ON RENAL PHYSIOLOGY OF
BODY FLUIDS AND TEMPERATURE REGULATION**

BY

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Question 1: Discuss the pathophysiological process involves in renal failure

Renal failure which is also known as kidney failure refers to the deterioration of renal functions resulting in a decline in the glomerular filtration rate (GFR) and rise in urea and non-nitrogenous substances in the blood. the kidneys are functioning at less than 15% of normal. Kidney failure occurs when your kidneys lose the ability to sufficiently filter waste from your blood. Many factors can interfere with your kidney health and function, such as:

- toxic exposure to environmental pollutants or certain medications
- certain acute and chronic diseases
- severe dehydration
- kidney trauma

Your body becomes overloaded with toxins if your kidneys can't do their regular job. This can lead to kidney failure, which can be life-threatening if left untreated.

Renal failure is classified as either:

- Acute kidney failure
- Chronic kidney failure

The type of renal failure is differentiated by the trend in the serum creatinine; other factors that may help differentiate acute kidney failure from chronic kidney failure include anemia and the kidney size on sonography as chronic kidney disease generally leads to anemia and small kidney size.

Acute kidney failure

Acute renal failure refers to a sudden decline in GFR over a period of days or weeks associated with the rapid rise in blood urea. It is a rapidly progressive loss of renal function, generally characterized by oliguria (decreased urine production, quantified as less than 400 mL per day in adults, less than 0.5 mL/kg/h in children or less than 1 mL/kg/h in infants); and fluid and electrolyte imbalance.

Acute kidney failure can result from a variety of causes, generally classified as prerenal, intrinsic, and postrenal. Many people diagnosed with paraquat intoxication experience AKI, sometimes requiring hemodialysis.

Chronic kidney failure

Chronic renal failure refers to 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. It initially shows few symptoms and can be the long-term consequence of irreversible acute disease or part of a disease progression

Symptoms of kidney failure

Usually someone with kidney failure will have a few symptoms of the disease. Sometimes no symptoms are present. Possible symptoms include:

- a reduced amount of urine
- swelling of your legs, ankles, and feet from retention of fluids caused by the failure of the kidneys to eliminate water waste
- unexplained shortness of breath
- excessive drowsiness or fatigue
- persistent nausea
- confusion
- pain or pressure in your chest
- seizures
- coma

Causes of kidney failure

Kidney failure can be the result of several conditions or causes. The cause typically also determines the type of kidney failure.

People who are most at risk usually have one or more of the following causes:

Loss of blood flow to the kidneys

A sudden loss of blood flow to your kidneys can prompt kidney failure. Some conditions that cause loss of blood flow to the kidneys include:

- a heart attack
- heart disease
- scarring of the liver or liver failure
- dehydration
- a severe burn
- an allergic reaction
- a severe infection, such as sepsis

High blood pressure and anti-inflammatory medications can also limit blood flow.

Urine elimination problems

When your body can't eliminate urine, toxins build up and overload the kidneys. Some cancers can block the urine passageways, such as:

- prostate (most common type in men)

- colon
- cervical
- bladder

Other conditions can interfere with urination and possibly lead to kidney failure, including:

- kidney stones
- an enlarged prostate
- blood clots within your urinary tract
- damage to your nerves that control your bladder

Other causes

Some other things that may lead to kidney failure include:

- a blood clot in or around your kidneys
- infection
- an overload of toxins from heavy metals
- drugs and alcohol
- vasculitis, an inflammation of blood vessels
- lupus, an autoimmune disease that can cause inflammation of many body organs
- glomerulonephritis, an inflammation of the small blood vessels of the kidneys
- hemolytic uremic syndrome, which involves the breakdown of red blood cells following a bacterial infection, usually of the intestines
- multiple myeloma, a cancer of the plasma cells in your bone marrow
- scleroderma, an autoimmune condition that affects your skin
- thrombotic thrombocytopenic purpura, a disorder that causes blood clots in small vessels
- chemotherapy drugs that treat cancer and some autoimmune diseases
- dyes used in some imaging tests
- certain antibiotics
- uncontrolled diabetes

Question 2: With the aid of suitable diagrams discuss the types of dialysis you know

Dialysis is the procedure to remove waste materials and toxic substances and to restore normal volume and composition of body fluid in severe renal failure. It is also called **hemodialysis**. Dialysis works on the principles of the diffusion of solutes and ultrafiltration of fluid across a semi-permeable membrane.

Dialysis performs the function of the kidneys if they've failed. In hemodialysis, the wastes and excess water are removed by using an external filter called a dialyzer, which contains a semipermeable membrane. The separation of wastes is done by creating a counter-current flow gradient, where blood flow is in one direction and the fluid of the dialyzer is in the opposite direction.

Types of dialysis

There are three primary and two secondary types of dialysis:

The primary dialysis:

- Hemodialysis
- Peritoneal dialysis
- Hemofiltration

The secondary dialysis:

- Hemodiafiltration
- Intestinal dialysis

HEMODIALYSIS

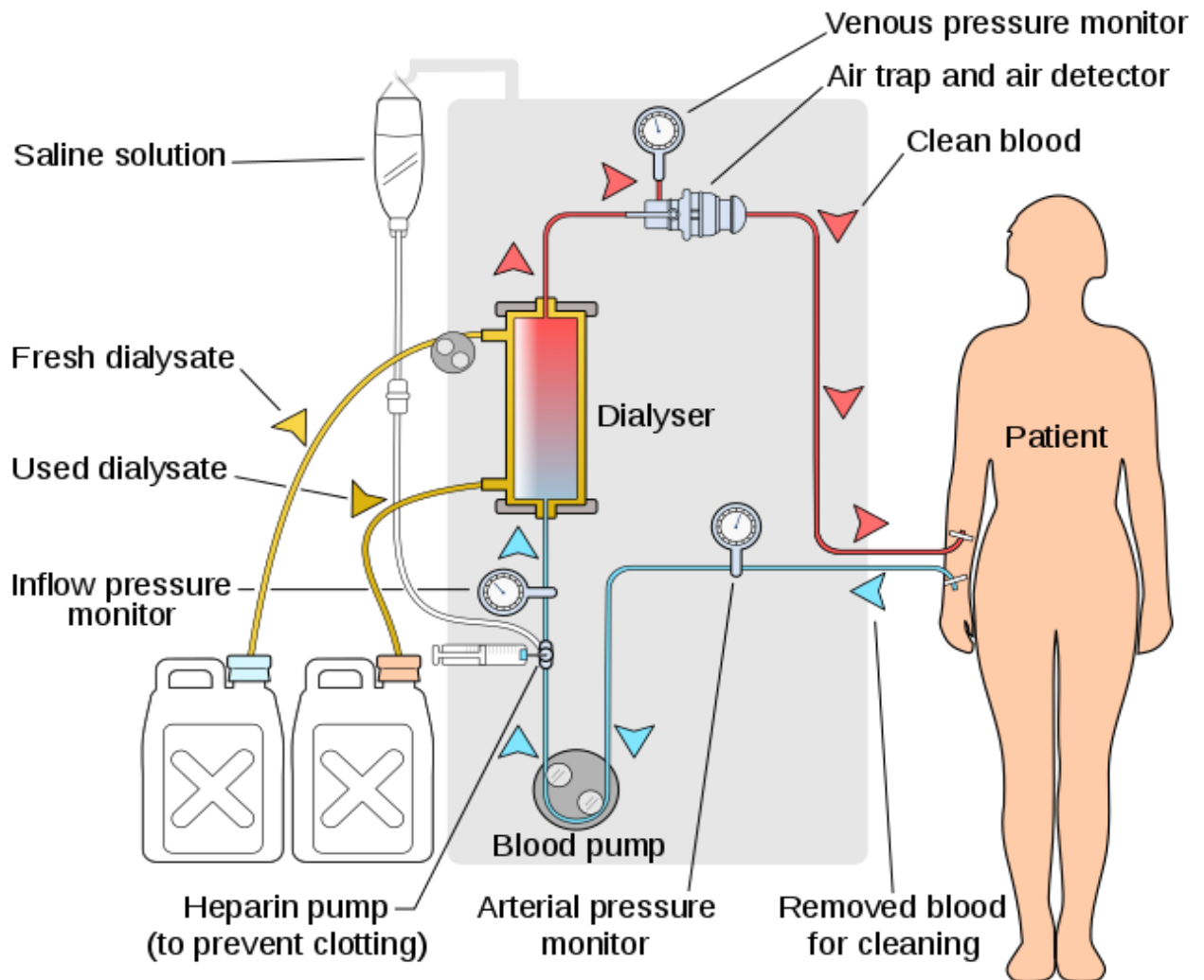
Hemodialysis is the most common type of dialysis. This process uses an artificial kidney (hemodialyzer) to remove waste and extra fluid from the blood. The blood is removed from the body and filtered through the artificial kidney. The filtered blood is then returned to the body with the help of a dialysis machine.

To get the blood to flow to the artificial kidney, your doctor will perform surgery to create an entrance point (vascular access) into your blood vessels.

The three types of entrance points are:

- Arteriovenous (AV) fistula: This type connects an artery and a vein. It's the preferred option.
- AV graft: This type is a looped tube.
- Vascular access catheter: This may be inserted into the large vein in your neck.

Both the AV fistula and AV graft are designed for long-term dialysis treatments.



HEMODIALYSIS

In hemodialysis, the patient's blood is pumped through the blood compartment of a dialyzer, exposing it to a partially permeable membrane. The dialyzer is composed of thousands of tiny hollow synthetic fibers. The fiber wall acts as the semipermeable membrane. Blood flows through the fibers, dialysis solution flows around the outside of the fibers, and water and wastes move between these two solutions. The cleansed blood is then returned via the circuit back to the body. Ultrafiltration occurs by increasing the hydrostatic pressure across the dialyzer membrane.

This usually is done by applying a negative pressure to the dialysate compartment of the dialyzer. This pressure gradient causes water and dissolved

solutes to move from blood to dialysate and allows the removal of several litres of excess fluid during a typical 4-hour treatment.

Risks associated with hemodialysis

Hemodialysis risks include:

- low blood pressure
- anemia, or not having enough red blood cells
- muscle cramping
- difficulty sleeping

Others include: itching, high blood potassium levels, pericarditis, an inflammation of the membrane around the heart, sepsis, bacteremia, or a bloodstream infection, irregular heartbeat.

PERITONEAL DIALYSIS

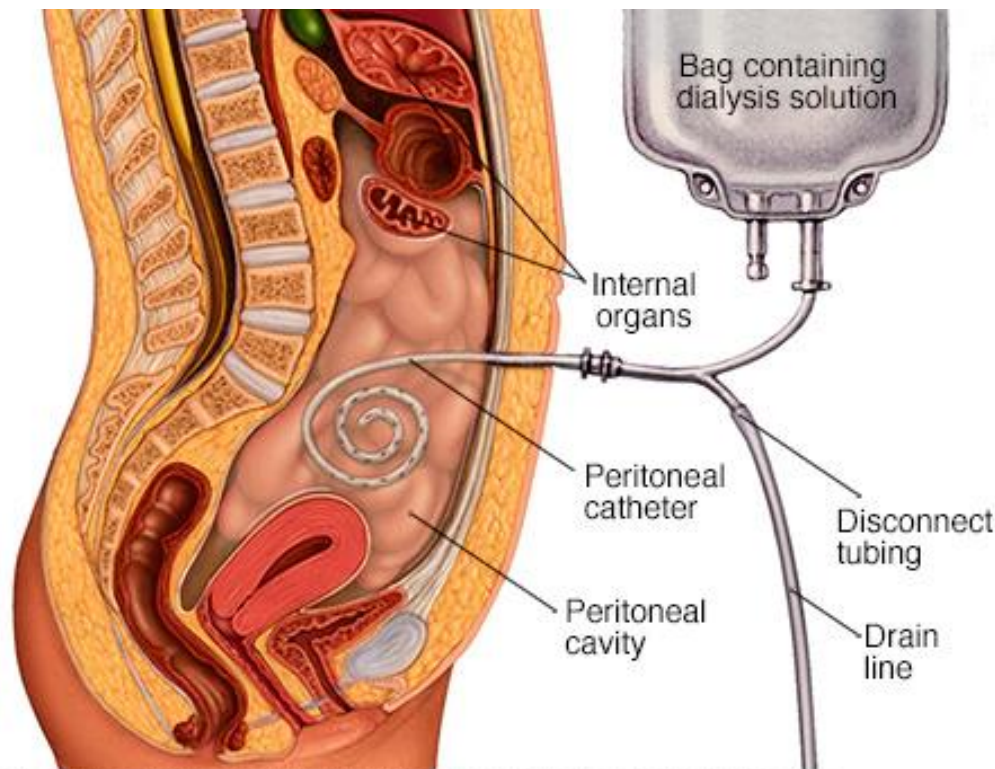
In peritoneal dialysis, a sterile solution containing glucose (called dialysate) is run through a tube into the peritoneal cavity, the abdominal body cavity around the intestine, where the peritoneal membrane acts as a partially permeable membrane. The special fluid, dialysate flows into the peritoneum and absorbs waste. Once the dialysate draws waste out of the bloodstream, it's drained from your abdomen.

This process takes a few hours and needs to be repeated four to six times per day.

Peritoneal dialysis is less efficient than hemodialysis, but because it is carried out for a longer period of time the net effect in terms of removal of waste products and of salt and water are similar to hemodialysis.

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

- 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.
- 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.
- 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.



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PERITONEAL 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.

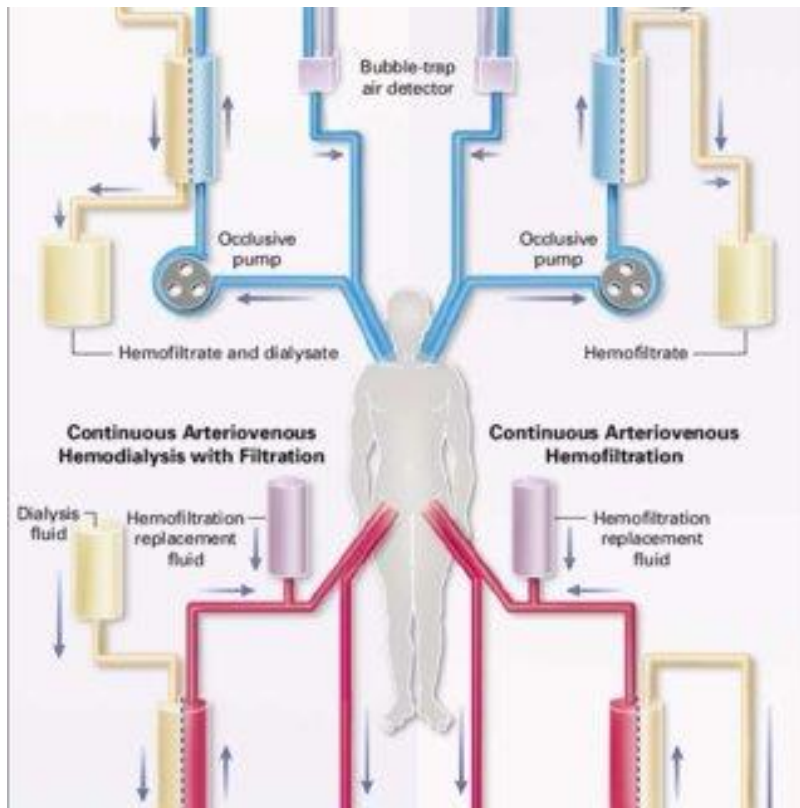
Other risks include: abdominal muscle weakening, high blood sugar due to the dextrose in the dialysate, weight gain, hernia, fever, stomach pain.

HEMOFILTRATION

Hemofiltration is a similar treatment to hemodialysis, but it makes use of a different principle. The blood is pumped through a dialyzer or "hemofilter" as in dialysis, but no dialysate is used.

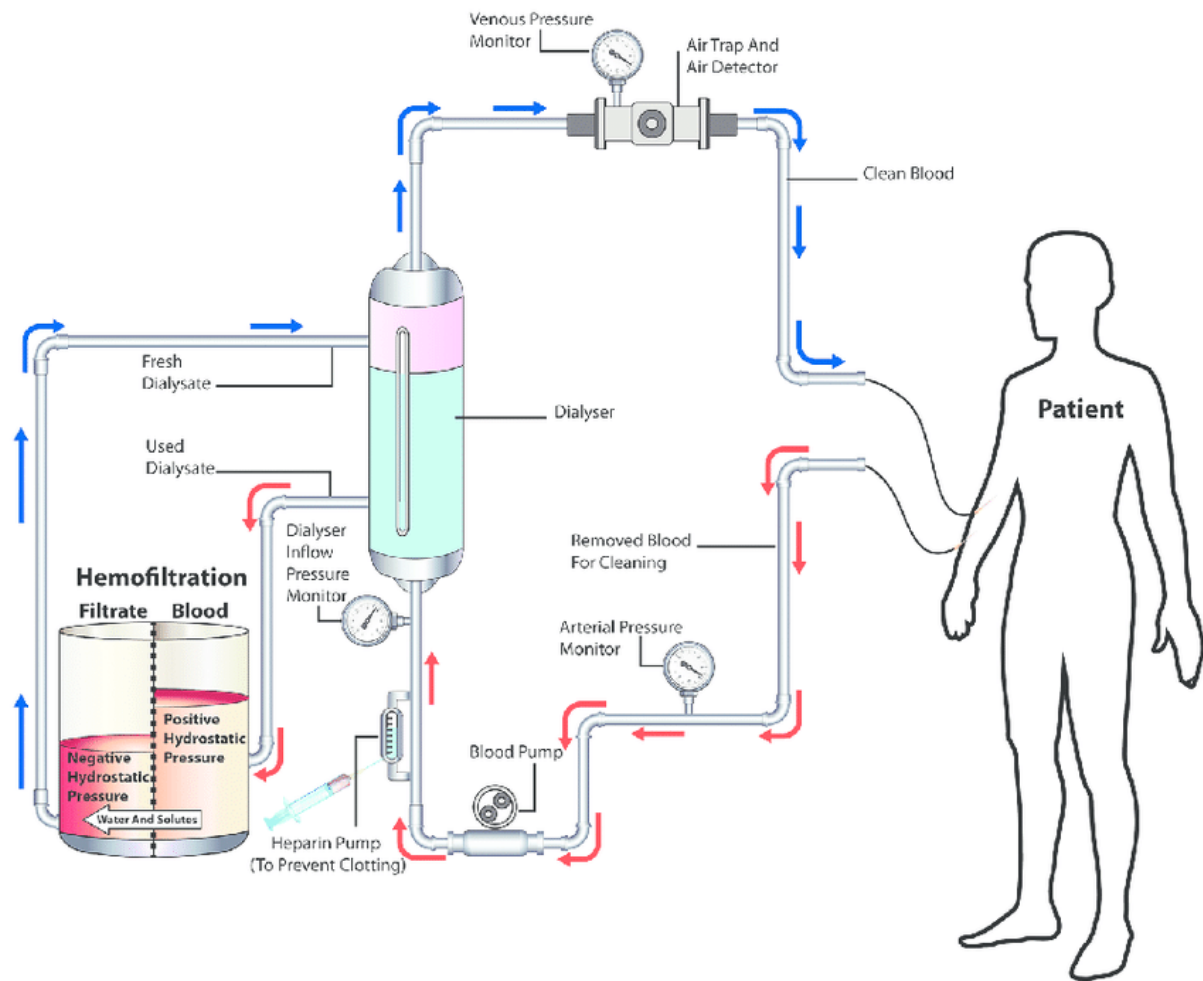
A pressure gradient is applied; as a result, water moves across the very permeable membrane rapidly, "dragging" along with it many dissolved substances, including ones with large molecular weights, which are not cleared as well by hemodialysis. Salts and water lost from the blood during this process

are replaced with a "substitution fluid" that is infused into the extracorporeal circuit during the treatment.



HEMODIAFILTRATION

Hemodiafiltration is a combination of hemodialysis and hemofiltration, thus used to purify the blood from toxins when the kidney is not working normally and also used to treat acute kidney injury (AKI).



INTESTINAL DIALYSIS

In intestinal dialysis, the diet is supplemented with soluble fibres such as acacia fibre, which is digested by bacteria in the colon. This bacterial growth increases the amount of nitrogen that is eliminated in fecal waste. An alternative approach utilizes the ingestion of 1 to 1.5 liters of non-absorbable solutions of polyethylene glycol or mannitol every fourth hour.