NAME: OLAKADA FAVOUR ADAMBA

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COURSE CODE: PHS 303

ASSIGNMENT TITLE: RENAL PHYSIOLOGY

LEVEL: 300

QUESTION

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

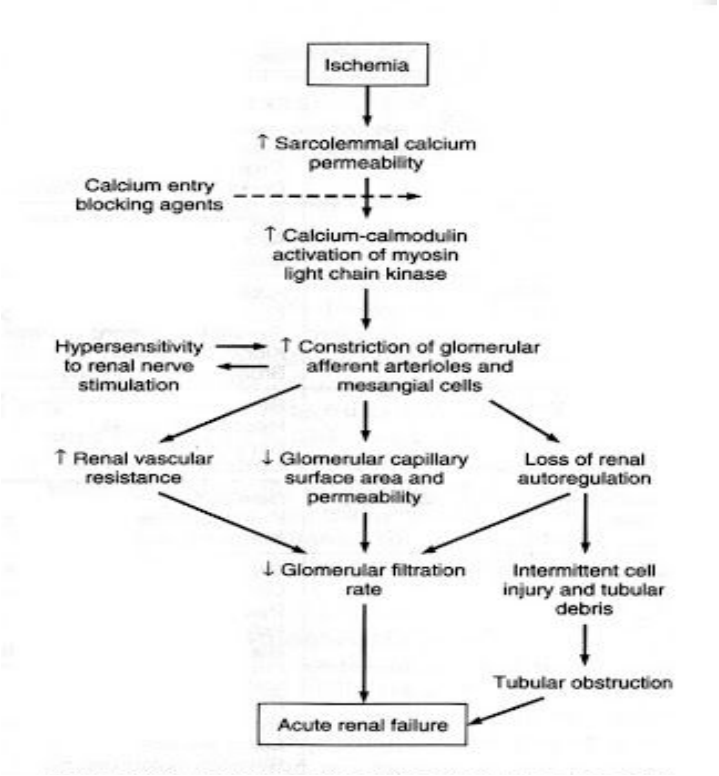
ANSWER

1. PATHOLOGICAL PROCESS INVOLVED IN RENAL FAILURE

Renal failure 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. It is of two types; acute renal failure and chronic renal failure.

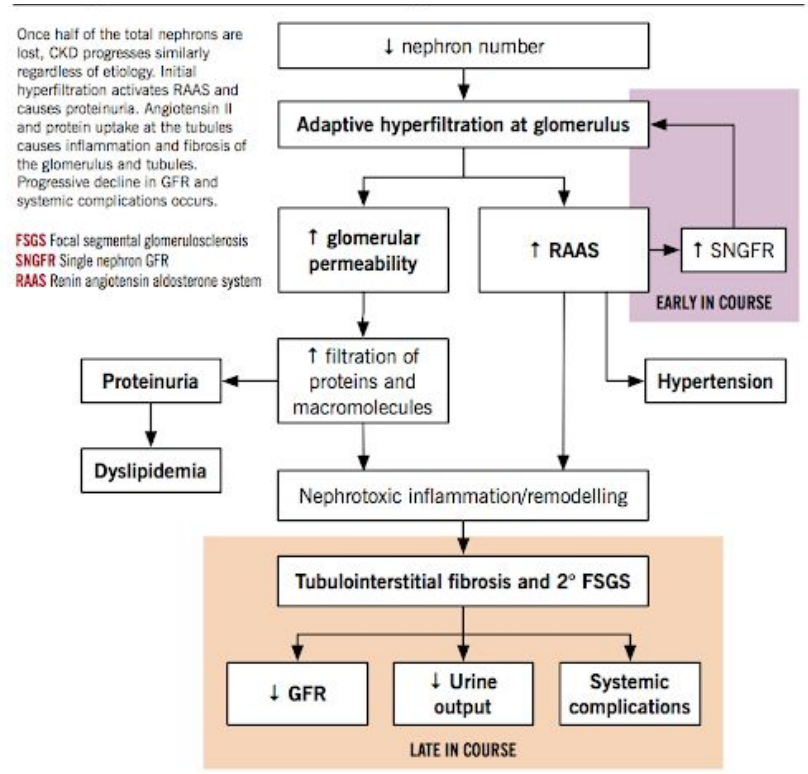
Acute Renal Failure

Acute renal failure refers to a sudden decline in glomerular filtration rate (GFR) over a period of days or weeks associated with the rapid rise in blood urea. The diagram below shows its pathophysiology:



Chronic Renal Failure

Chronic renal failure 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 endocrine abnormalities. The image below shows its pathophysiology:



2. DIALYSIS

The term dialysis in physiological sense refers to the diffusion of solutes from an area of higher concentration to the area of lower concentration through a semipermeable membrane. This principle has been used to dialyse the blood of patients with renal failure especially those developing uraemia. By dialysis, the dissolved crystalloids of the plasma pass through a semipermeable membrane so that their levels are brought down to lower levels. Two types of dialysis procedures are available:

- Haemodialysis or artificial kidney
- Peritoneal dialysis.

Haemodialysis or Artificial Kidney

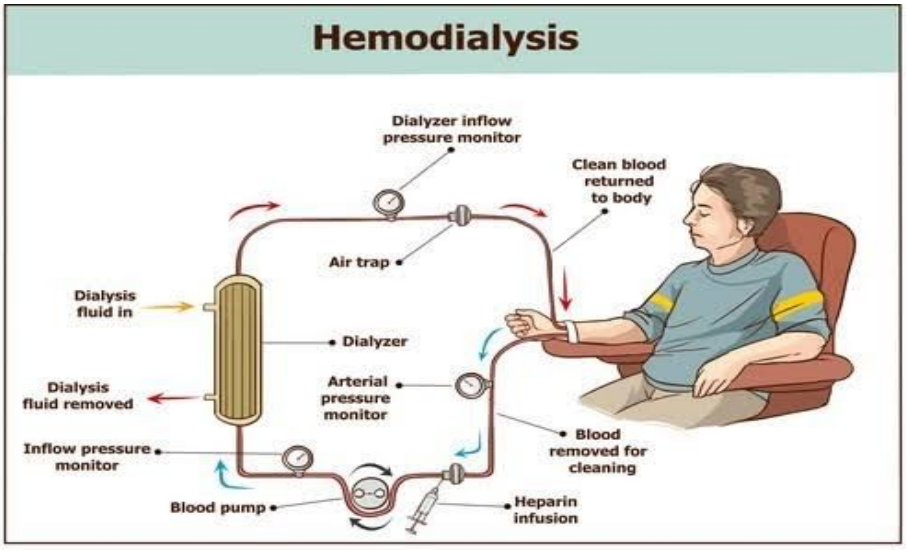
Haemodialysis machine is also called an artificial kidney. Haemodialysis is done in a hospitalized patient through intravenous (IV) line for 3–5 h. During haemodialysis, the patient's radial artery is connected to the haemodialysis machine. Inside the haemodialysis machine, the blood is passed through a long and coiled cellophane tube immersed in a dialysis fluid(it is called dialysate). The blood passes through a dialyzer called hemofilter, which contains minute channels imposed between two cellophane membranes. The

cellophane membranes are porous in nature. Heparin is used as an anticoagulant while passing the blood through the machine.

Dialyzing fluid; the composition of a dialyzing fluid is similar to that of the plasma, except it is free of waste products like urea, uric acid, etc. The fluid contains less amount of sodium, potassium and chloride ions than in the uraemic blood. But the quantity of glucose, bicarbonate and calcium ions are more in the dialyzing fluid than in the uraemic blood.

During haemolysis, the semipermeable cellophane membrane permits the free diffusion of the constituents of plasma except proteins. In this way, the dialysis of a patient's blood removes the toxic waste products and restores normal electrolyte concentration in the plasma. The dialysed blood is returned back to the patient’s body through a peripheral vein.

At a time about 500 mL is passed through the artificial kidney. Haemodialysis is done usually thrice a week in severe uraemia. The rate of blood flow through the dialysis machine is about 200 to 300mL/min. The rate of dialysate flow is about 500mL/minute. Haemodialysis can save lives in many types of acute renal failure. The intermittent haemodialysis may prolong the life of many patients with chronic renal failure, which may lead an active life for many useful years. The dialysis can partially replace the excretory function of the kidneys but does not replace endocrine and metabolic functions.



Peritoneal Dialysis

Peritoneal dialysis is a form of long-term dialysis done by the patients at home or at work. In this type of dialysis, the peritoneum acts as a semipermeable membrane. Two litres of dialyzing fluid is introduced through an intraperitoneal catheter. It is then kept in the peritoneal cavity for exchange to take place for a period of 15–20 min called dwell time. Fluid is then drained out and measured. A strict input and output chart is maintained. The whole procedure constitutes one cycle. It is done at 6 h intervals (4 cycles/day), even when the patient is ambulatory or mobile.

There is no need for hospitalization. It is useful for young children and old patients with cardiovascular disorders. It prolongs survival in patients with chronic renal failure for many years. Peritoneal dialysis is not very suitable for drug poisoning cases.