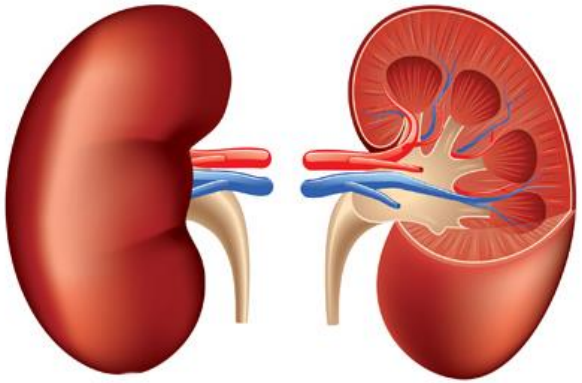
Ashur University
College of Medicine

Grade 2
PHYSIOLOGY OF URINARY SYSTEM
US - Medicine

Acute Renal Failure



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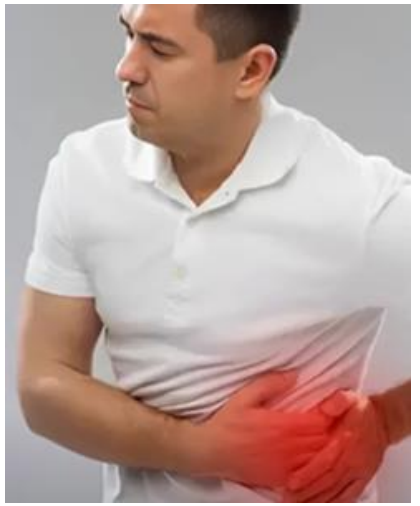
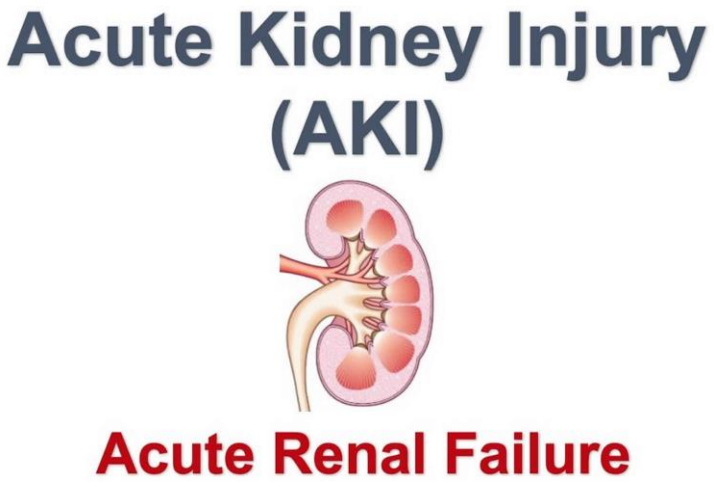
18/2/2025

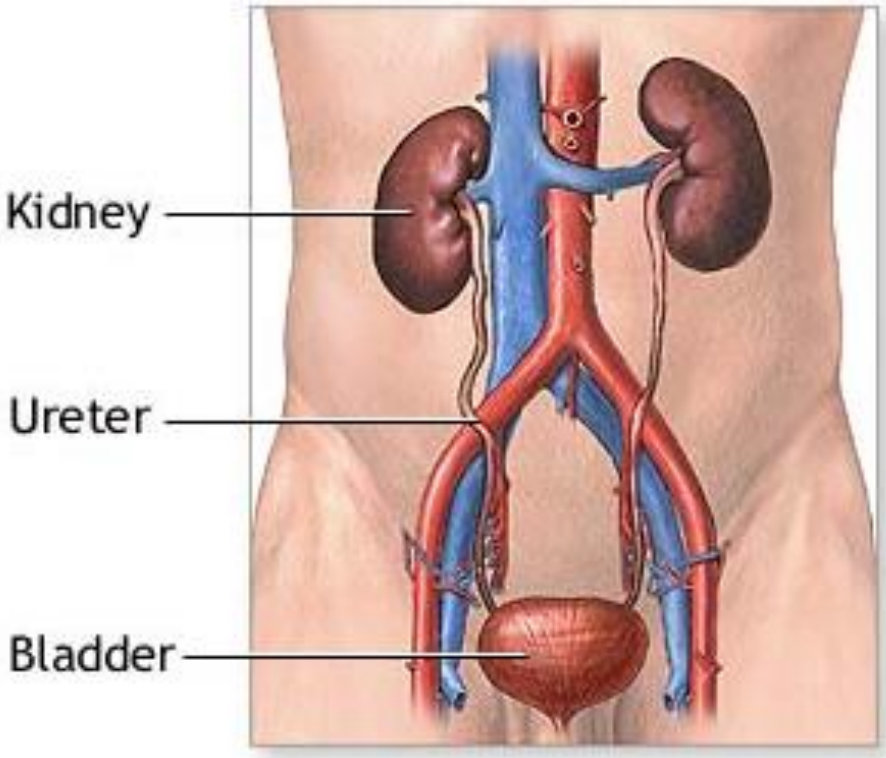


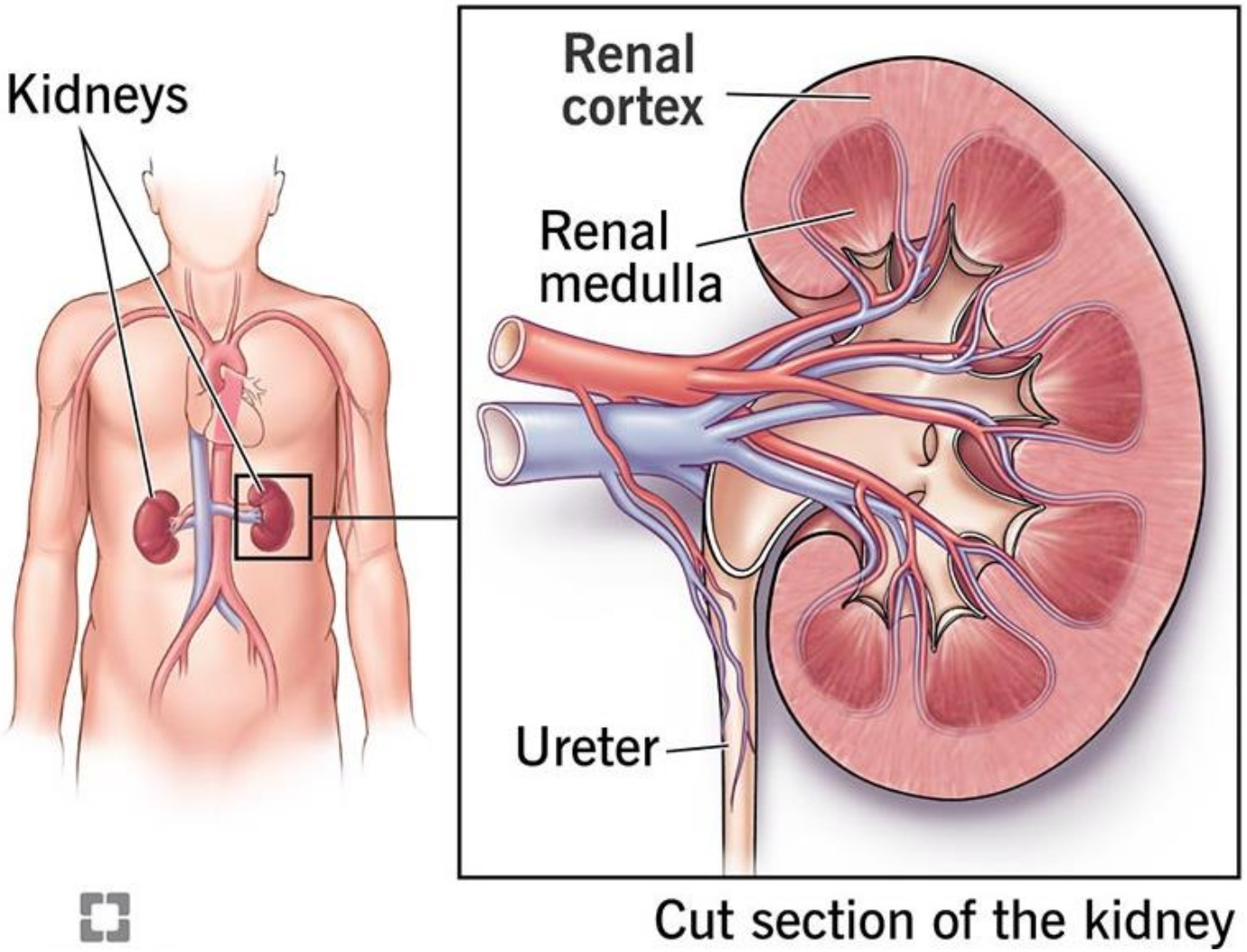
Objectives

- Describe the etiology & categories of Acute Kidney Injury (AKI)
- Determine the principles of management of AKI
- Apply of appropriate investigations
- State of indications for dialysis
- Predict of complications and management of hyperkalemia.



Kidney Anatomy





Kidney function

- Detoxify blood
- Regulate blood pressure
- Regulates electrolyte and fluid balance

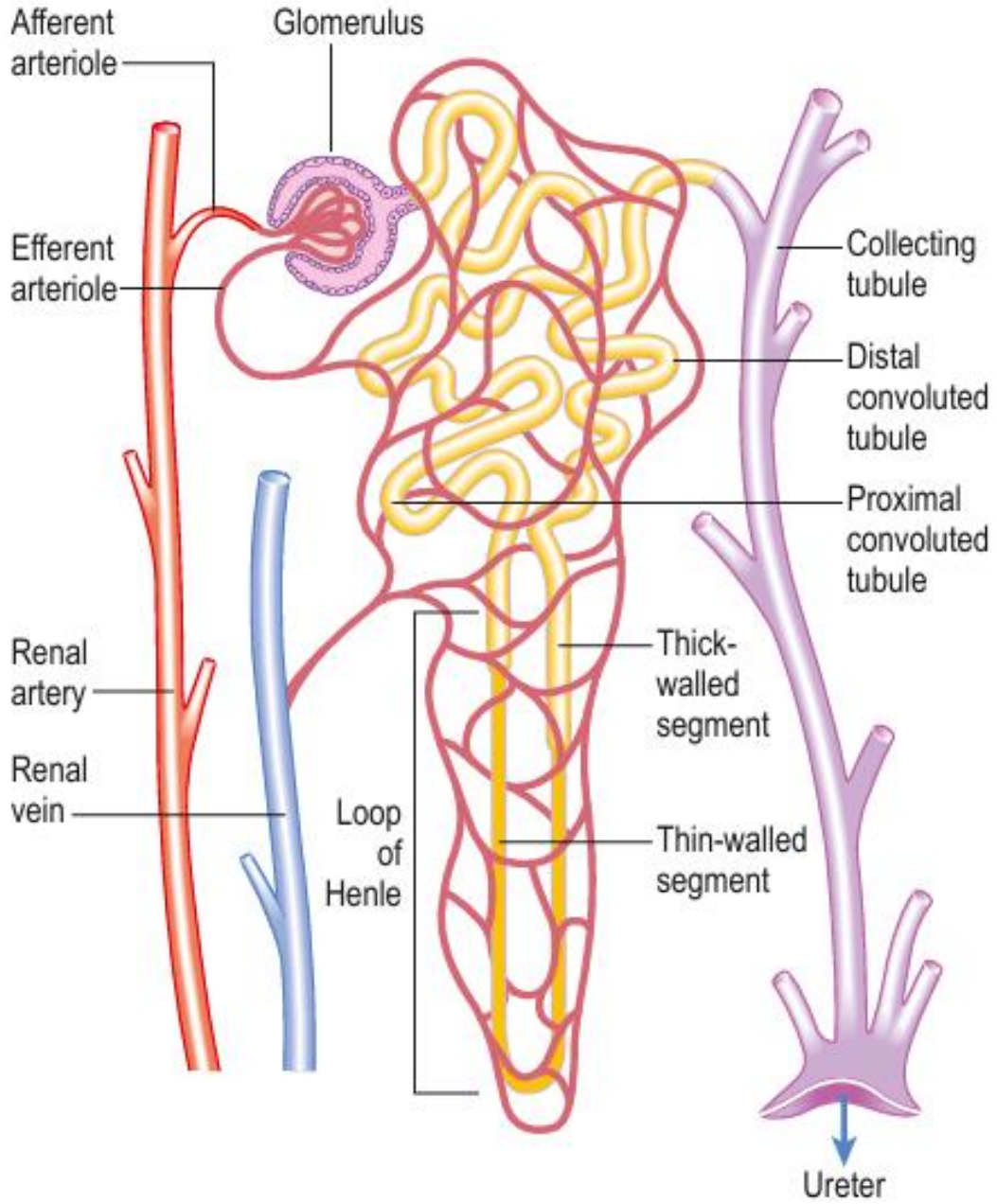


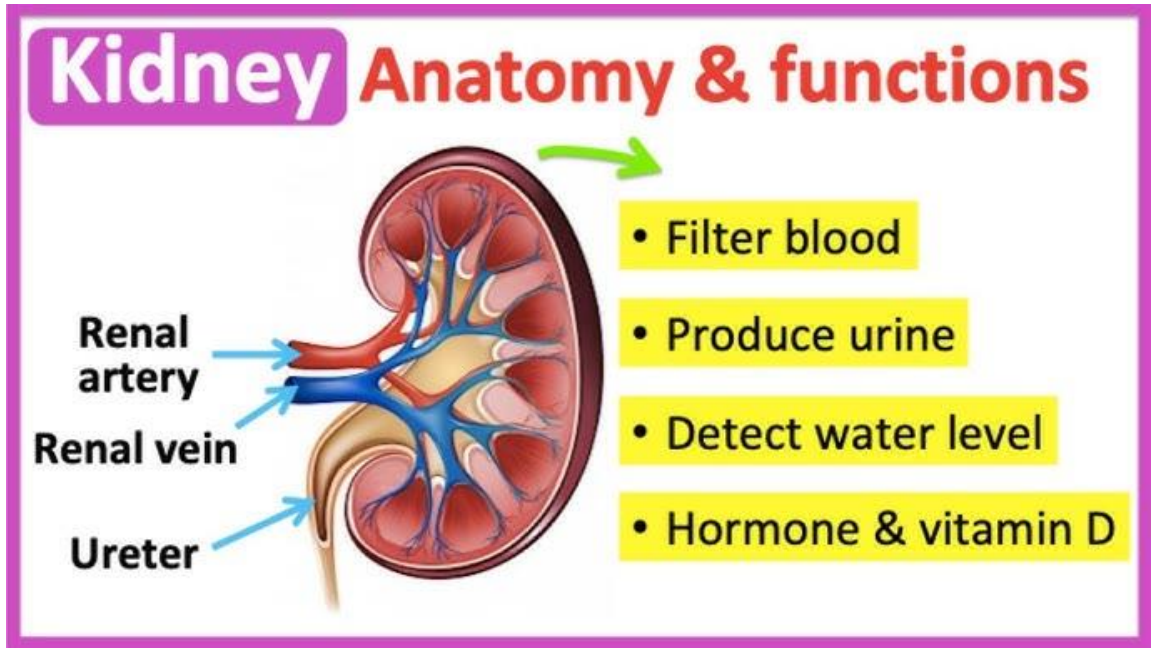
Fig. A single nephron →

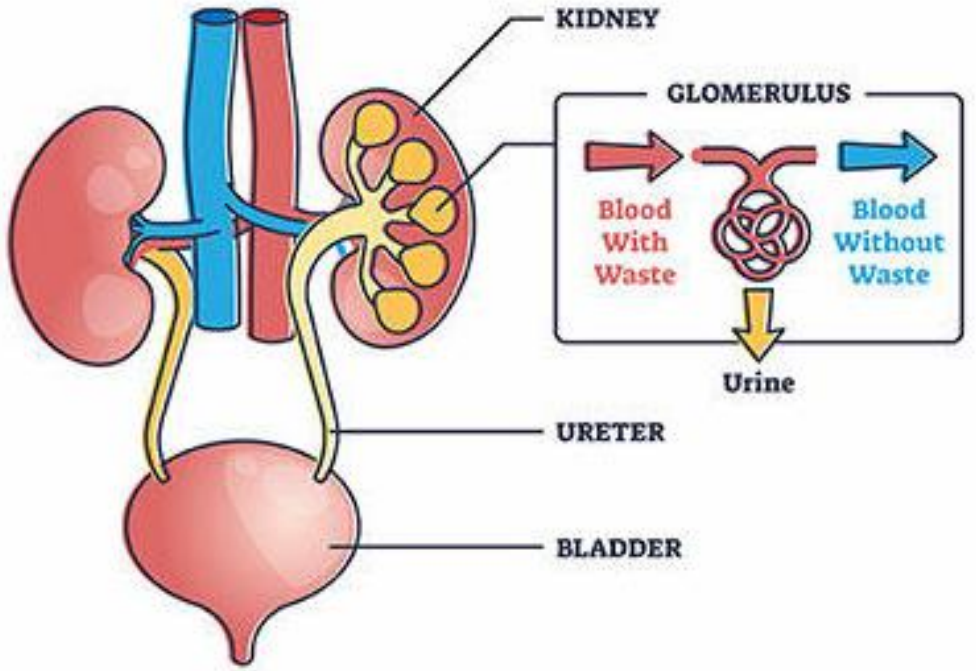
Kidney to function properly

- **Normal renal blood flow**
- **Normal Functioning glomeruli and tubule**
- **Clear outflow tract :**

for drainage and elimination of formed urine

from the body.





Acute renal failure (ARF)

- **ARF; also referred to as acute kidney injury (AKI)** describes a **sudden** and usually **reversible** loss of renal function, which develops over days or weeks and is usually accompanied by a **reduction in urine volume**.
- **Azotaemia:** retention of urea and other nitrogen compounds in blood.
- **Uraemia :** synonymous (same) with azotaemia, also means uraemic syndrome,i.e., the clinical manifestation of renal failure.

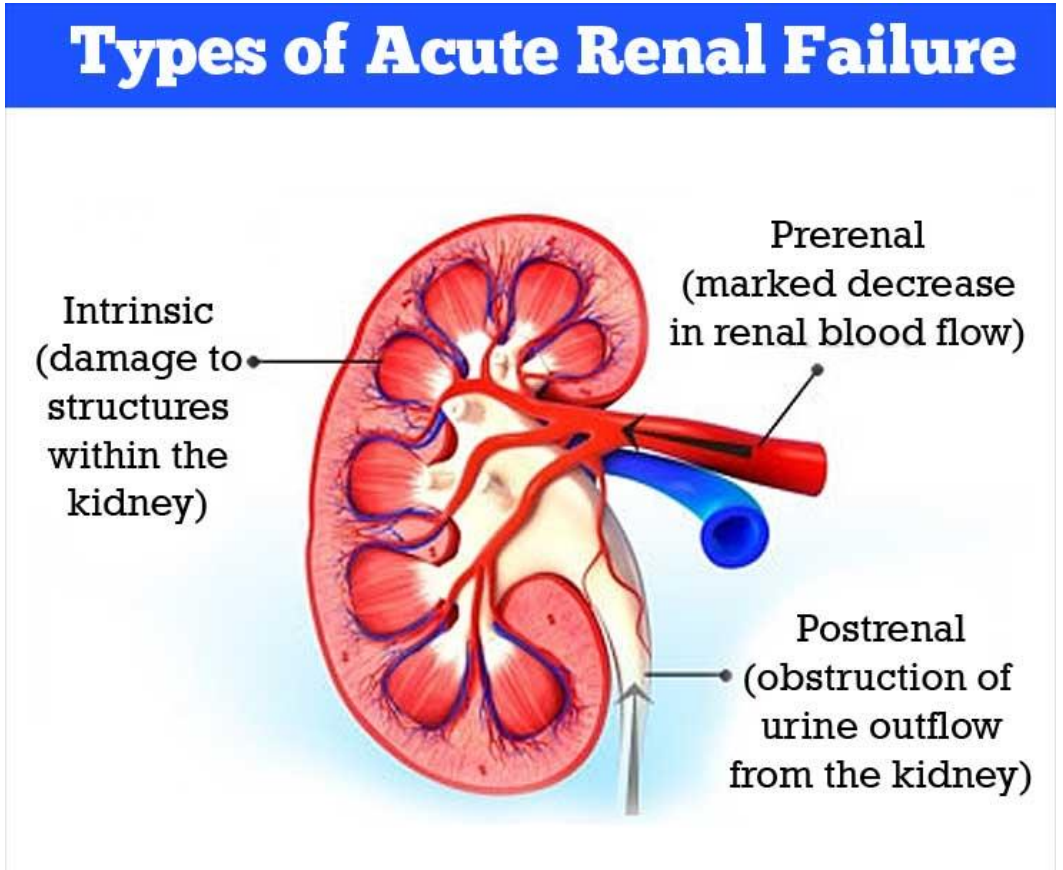
- **Oliguria : < 400 ml / 24 hours**
- **Anuria : < 100 ml /24 hours**
- **Nonoliguric ARF > 400 ml / 24 hours**

- **Acute Renal Failure :**
  - sudden onset
  - rapid reduction in urine output
  - Usually reversible



Classifications

- **Pre-renal (55%)**
- **Renal parenchymal (Intrinsic) (40%)**
- **Post-renal (5-15%)**



Causes of ARF

Pre-renal

Systemic
- Heart failure
- Blood or fluid loss

Local
- Renal artery occlusion/stenosis
- Diseases affecting arterioles

Under-perfusion initially causes reversible changes. Subsequently, 'acute tubular necrosis' or other changes cause longer-lasting, but usually temporary, intrinsic renal failure





Intrinsic renal disease

Acute tubular necrosis/ toxic/septic renal failure	85%
Glomerular disease	5%
Primary	
Component of systemic disease	
Interstitial disease	10%

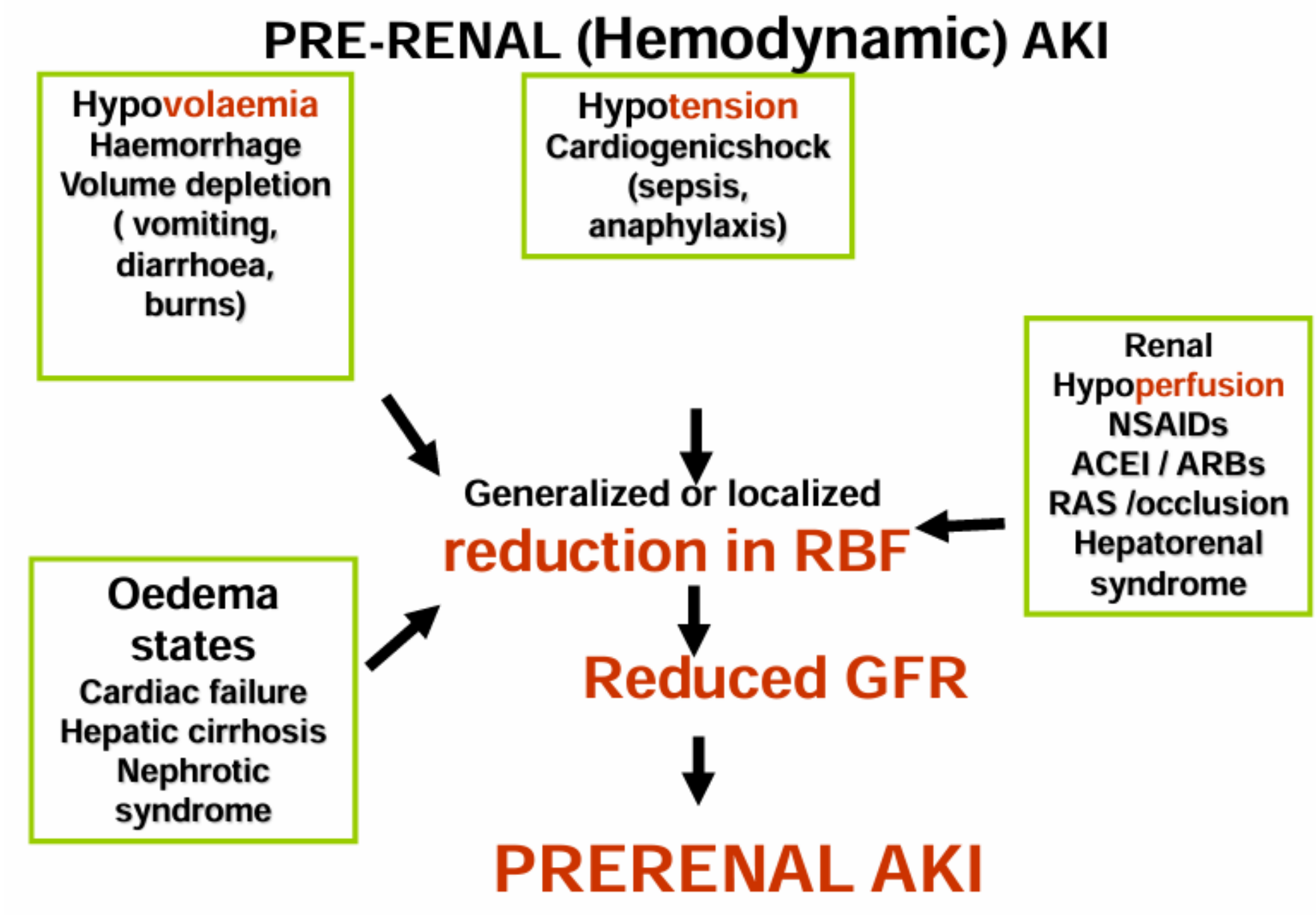
Post-renal

Obstruction
- e.g. Stones
- Tumour
- Prostatic enlargement

Causes of ARF

- **Pre-renal**
  – vomiting, diarrhea, cardiac failure, septic shock ,others
- **Intrinsic**
  – Interstitial nephritis, acute glomerulonephritis, tubular necrosis, toxins
- **Post-renal**
  -prostatic hypertrophy, bilateral renal calculi, bladder carcinoma.

PRE-RENAL (Hemodynamic) AKI



RBF :

Renal **B**lood **F**low

GFR :

Golmerular
Filtration **R**ate

ACEI :

Angiotnsin
Converting
Enzyme **I**nhibitors

ARBs :

Angiotensin
Receptor **B**lockers

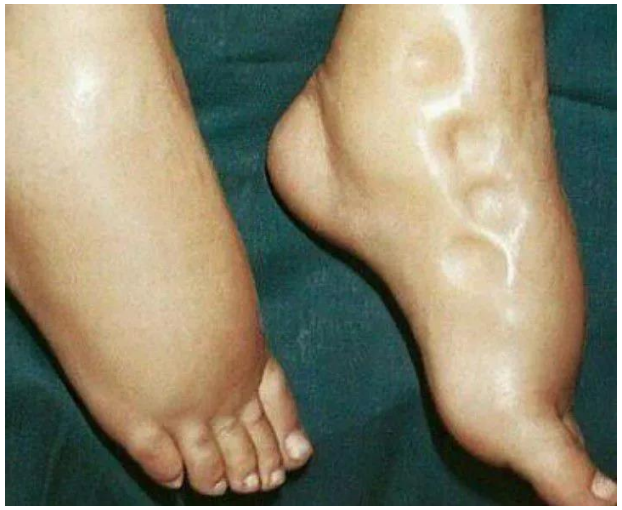
RAS :

Renal **A**rtery
Stenosis

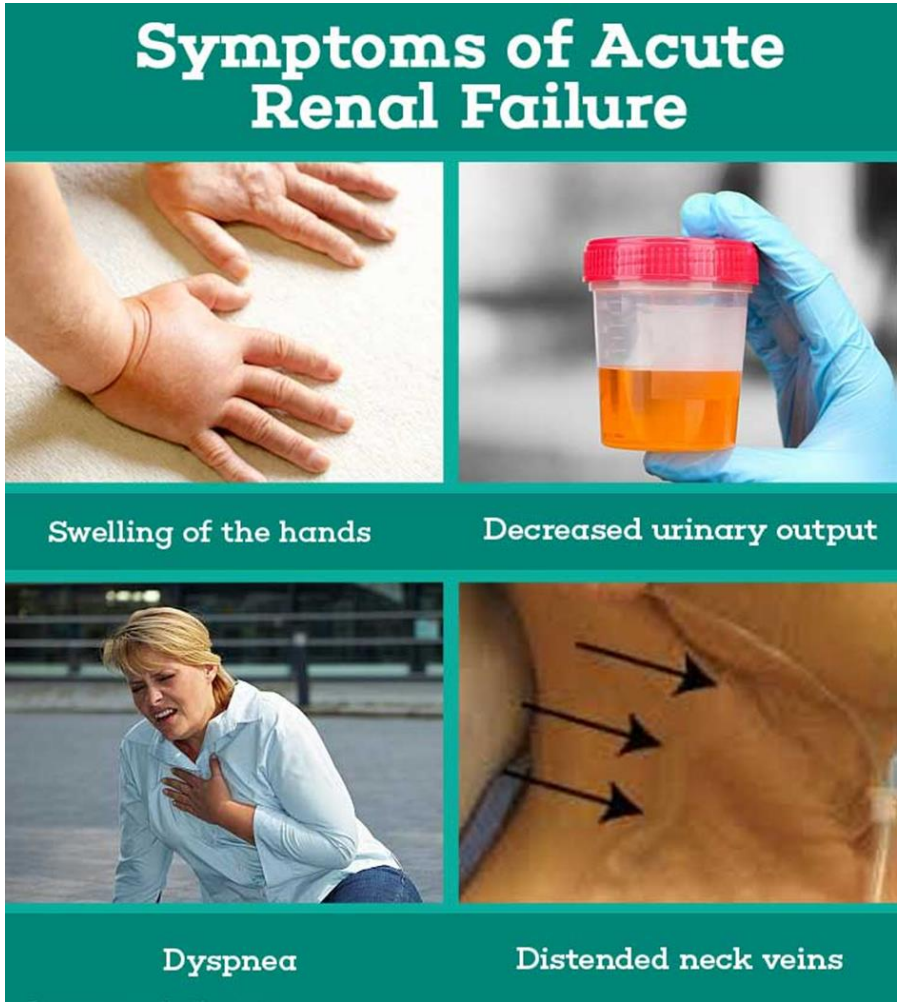
Symptoms of ARF

- Decrease urine output (70%)
- Edema, esp. lower extremity
- Mental changes
- Nausea, vomiting
- Tachypenia









Diagnosis of ARF

- **History**
- **Physical Examination**
- **Urine output measurement** :

  Urine collection in 24 Hours.
- **Investigation :**

  Urine analysis

  Blood tests – CBC

  Renal function tests – Urea ,

  Creatinine ,Potassium , Sodium ,

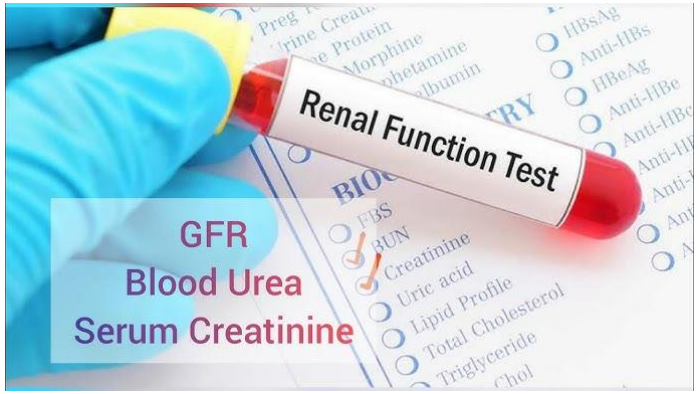
  Calcium, Bicarbanate , Total protein ,

  Albumin
- **Imaging studies** – Ultrasound , Computed tomography (CT Scan)













Management

➢ **Maintenance of**

-Volume homeostasis (Assess fluid status, Fluid resuscitation)

-Stop Nephrotoxic drugs

-Correction of biochemical abnormalities

➢ **Treat reversible elements**

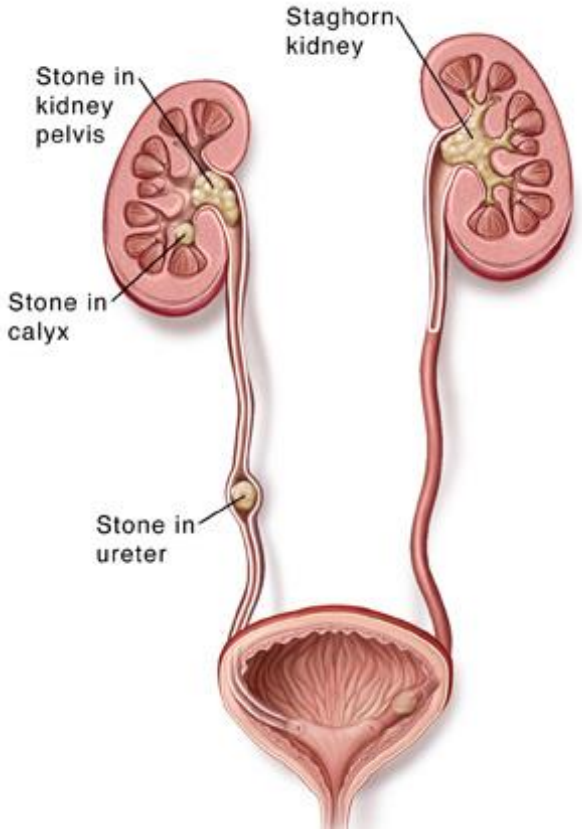
– **Hydrate**

– **Infection** – give antibiotics

– **Relieve obstruction**

Example (calculus obstruction surgical removal)







Hyperkalemia

Potassium range :

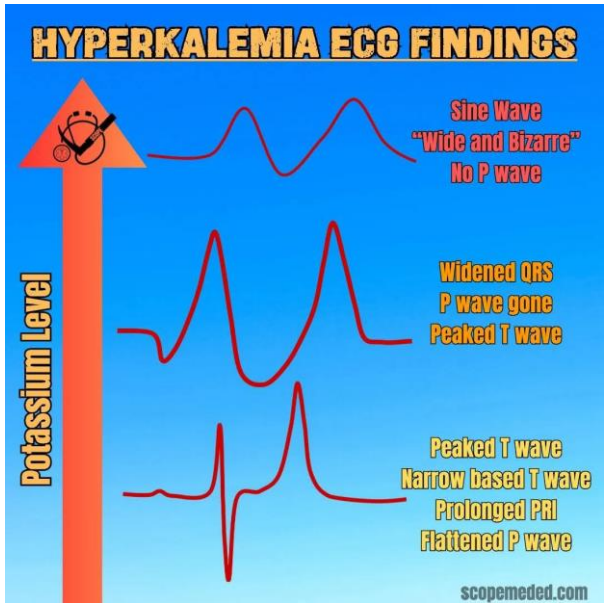
Normal is 3.5 – 5 mmol/L

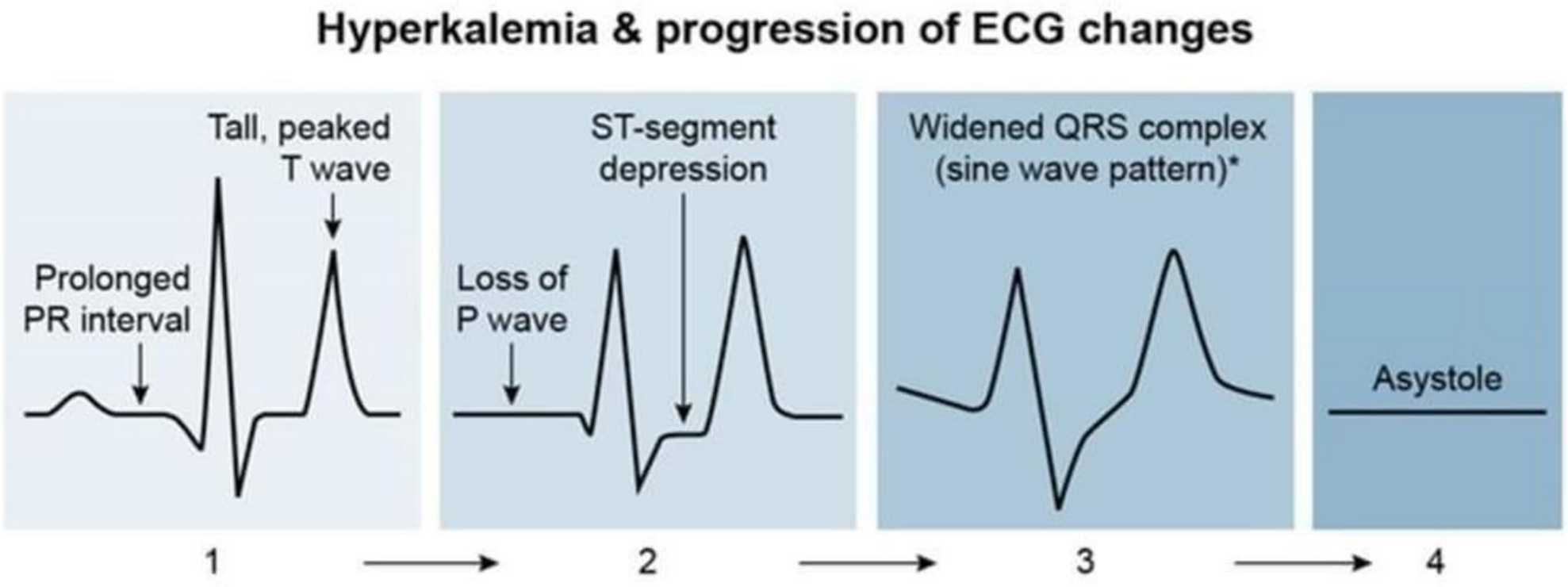
Increased to > 5.5 – 6 mmol/L.

Signs and Symptoms of hyperkalemia

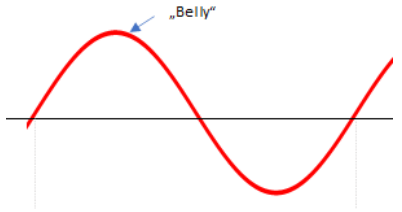
- Weakness
- Lethargy
- Dysrhythmias

- **ECG changes in hyperkalemia :**
- Tall peaked T waves
- Broad (wide) QRS complex
- Prolonged PR interval
- Flattened (diminished) P waves
- Prolonged QT
- QRS -T merge form Sine wave → Asystole (Cardiac arrest)





Sine wave



Management of hyperkalemia

Potassium >7 mmol/L

1-Calcium gluconate (10% 10 ml) →

(To remember 10,10,10 = 10%, 10 ml, 10 min.)

(10% solution into central vein or diluted into 40 ml 0.9% saline into peripheral vein over 10mins, with cardiac monitor)

2-Intravenous Dextrose and insulin →

(5% Dextrose 500 ml + 5 Unit Sol.Insulin)

(danger of hypoglycemia)

3-Nebulised salbutamol →







Management of hyperkalemia ..cont.

4-IV sodium bicarbonate solution ,

slowly diluted over 20 minutes according to body weight . →



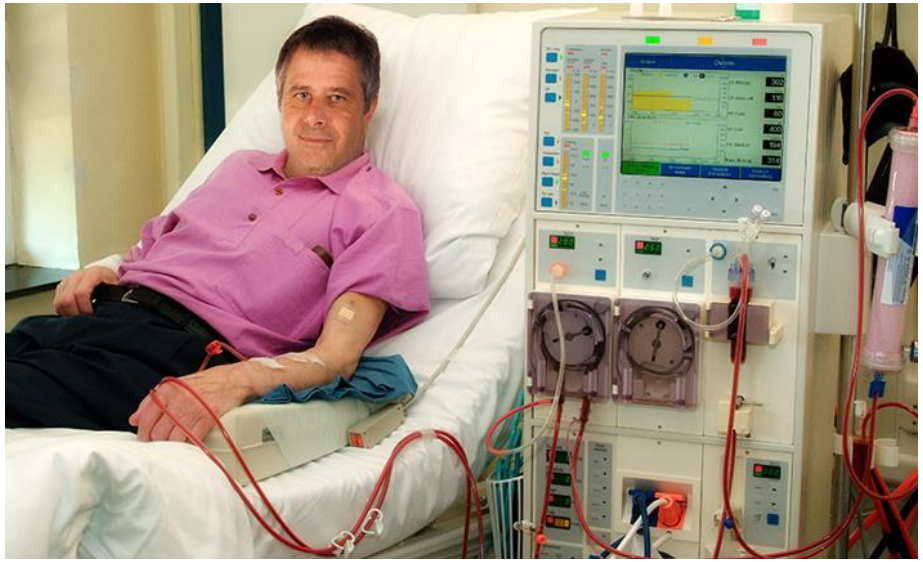
5-Calcium resonium orally

– Slowly act excrete K through GIT →

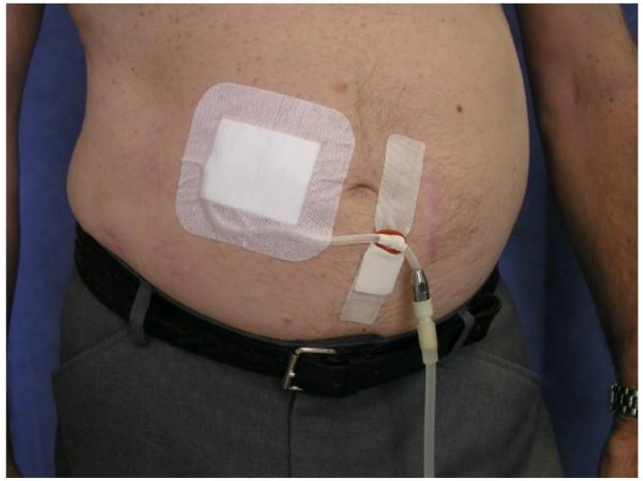


Dialysis

- Diffuse harmful waste out of body
- Control BP
- Keep safe level of electrolytes and acid base level in body
- **2 types**
  - **Hemodialysis →**
  - **Peritoneal dialysis →**







Indications for dialysis

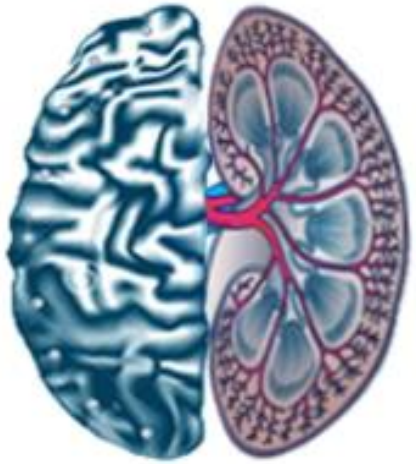
1- PERICARDITIS

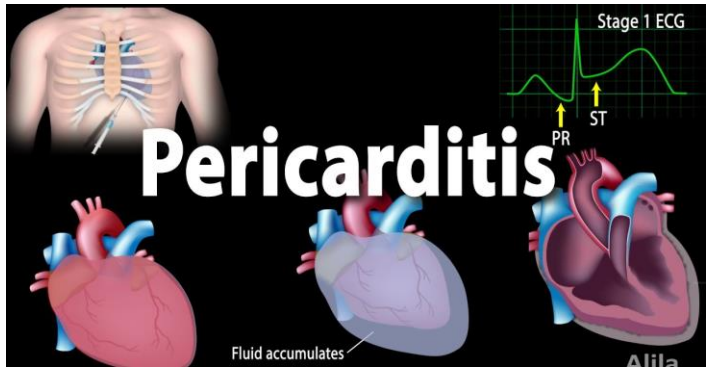
2- MENTAL STATUS CHANGE (Uremic encephalopathy)

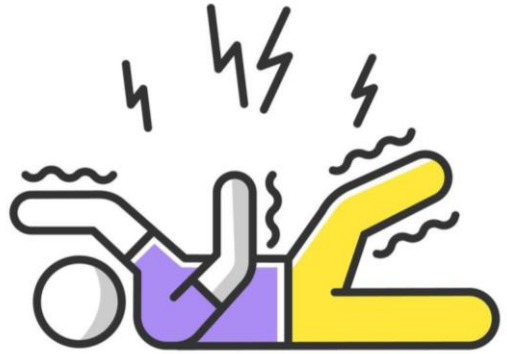
3- SEIZURES (Convulsion)

4- Uncontrollable hypertension , hyperkalemia or acidosis

4- Certain Toxins – Drugs e.g : NSAIDs , ACEI







EPILEPSY



Clinical scenario

A 70-year-old male with a history of hypertension and chronic osteoarthritis presents with decreased urine output and fatigue for the past two days. He recently had a viral illness with vomiting and diarrhea.

On examination, he is mildly confused, blood pressure is 90/60 mmHg, and he has dry mucous membranes.

Laboratory results show:

Serum creatinine: 3.0 mg/dL (baseline 1.0 mg/dL)

Blood urea: 60 mg/dL

Urinalysis: No casts or proteinuria

1. What is the most likely cause of this patient's acute renal failure?

A) Acute tubular necrosis (ATN)
B) Pre-renal azotemia
C) Post-renal obstruction
D) Glomerulonephritis
E) Acute interstitial nephritis

Correct answer B

Explanation: The patient has signs of dehydration (hypotension, dry mucous membranes) and lab findings suggesting pre-renal azotemia.

2. What is the best initial treatment for this patient?

A) IV normal saline
B) IV furosemide
C) Urgent dialysis
D) Renal biopsy
E) High-dose corticosteroids

Correct answer A

Explanation: The patient has pre-renal acute kidney injury due to dehydration, which is best treated with IV fluid resuscitation.


Thank
you!