Renal Failure

جامعة ساوة

كلية التقنيات الصحية والطبية

قسم تقنيات التخدير

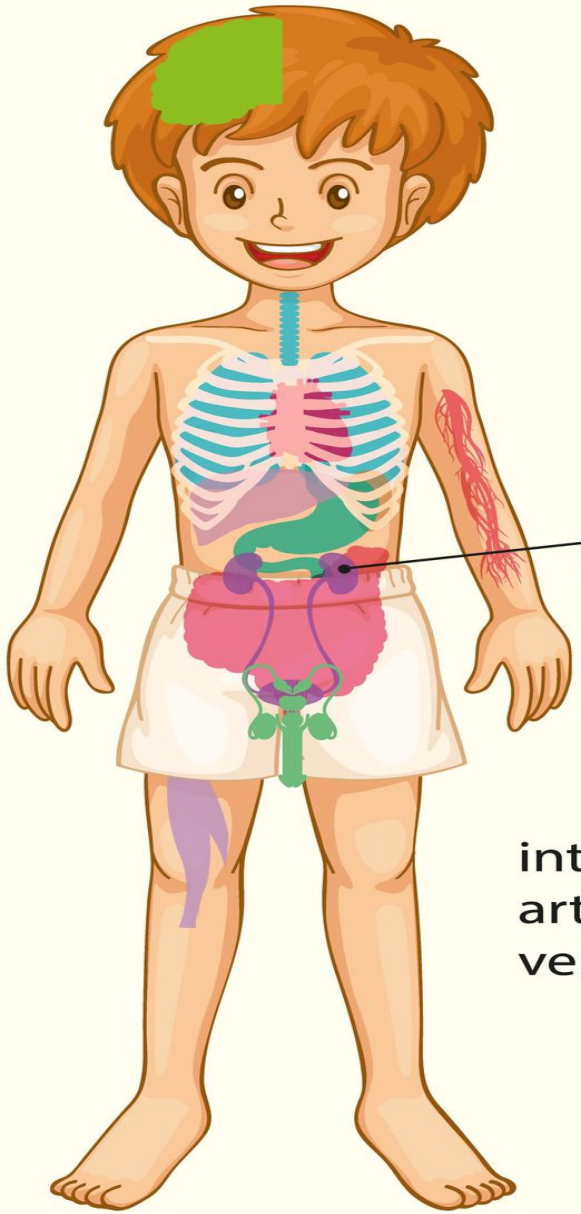
المرحلة الثالثة

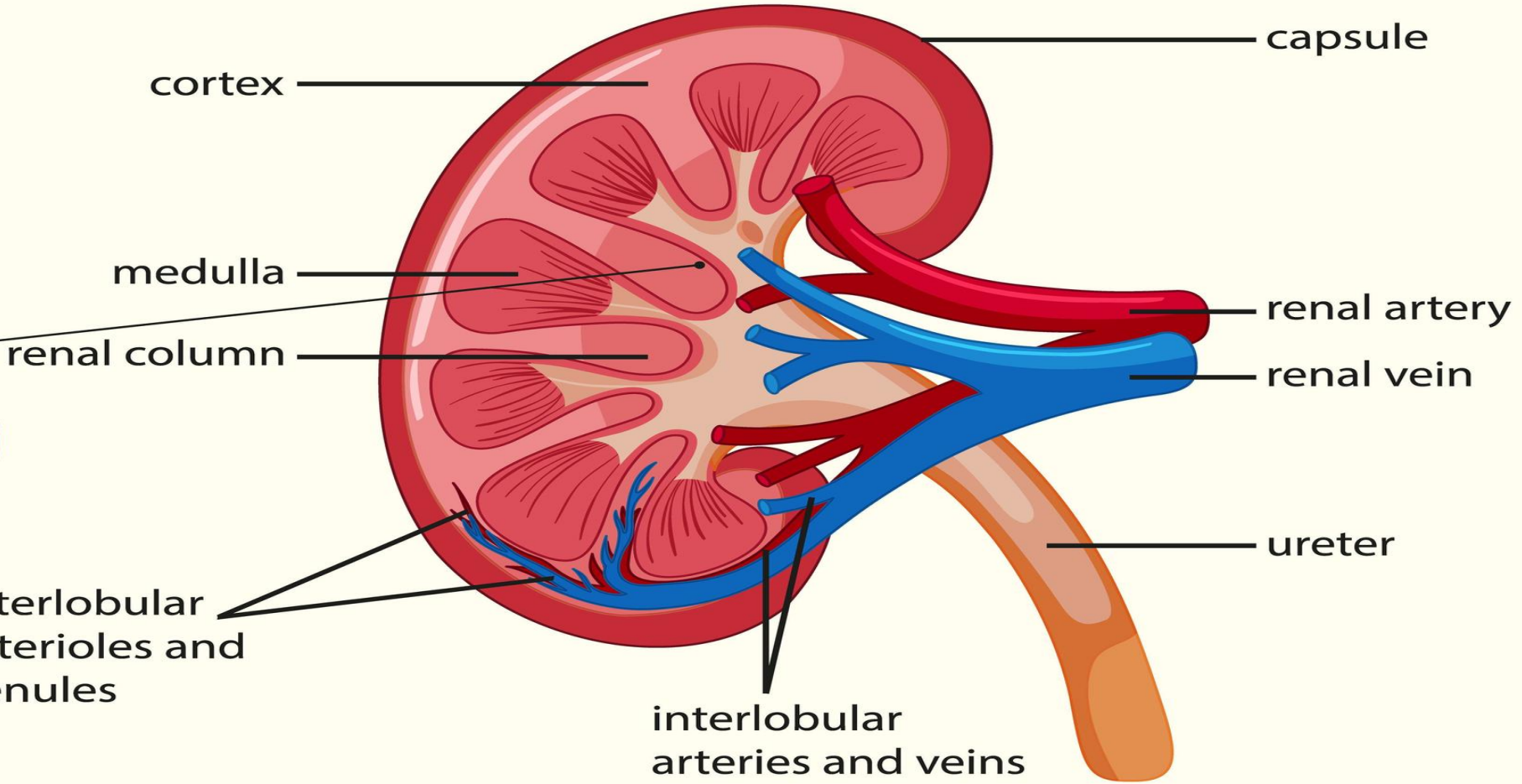
الطبيب الاختصاص

علاء محسن آل غريّب

المحاضرة الخامسة

Human Kidney Anatomy





KIDNEY FUNCTIONS

REMEMBER: "A WET BED"

- A — ACID-BASE BALANCE
- W — WATER BALANCE
- E — ELECTROLYTE BALANCE
- T — TOXIN REMOVAL
- B — BLOOD PRESSURE CONTROL
- E — ERYTHROPOIETIN PRODUCTION
- D — VIT D METABOLISM

Kidney functions

IMPORTANT

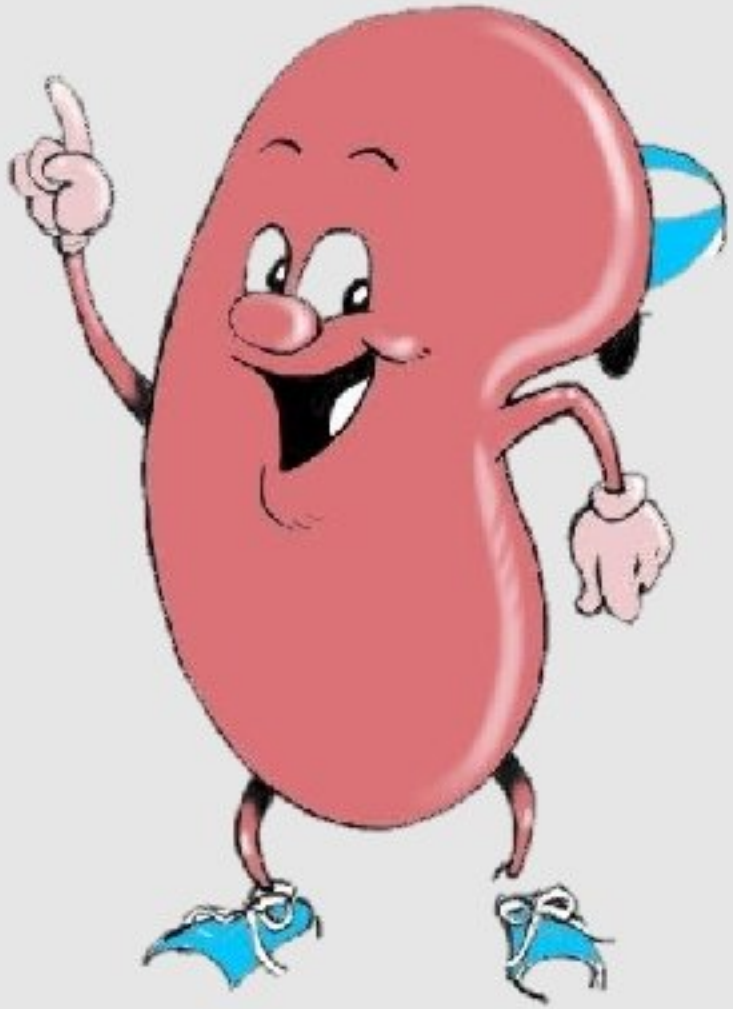
1. Regulation of the following :
- water and electrolyte balance.
- acid base balance.
- arterial blood pressure.
2. Excretion of metabolic waste products and foreign chemicals.

These metabolic wastes will be converted to intoxic (inactive) metabolites in the liver (catabolism reaction), then excreted in the urine by the kidney .

3. Hormonal Function : Secretion of erythropoietin & activation of vitamin D and activation of angiotensinogen by renin .

4. Metabolic Function : site for gluconeogenesis .

Formation of glucose from non carbohydrate precursors.

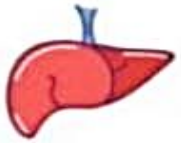


RENIN-ANGIOTENSIN-ALDOSTERONE SYSTEM

Multi-organ feedback mechanism which regulates blood pressure by managing fluid & electrolyte balance and vascular tone

↓BP CAUSES ↓BLOOD FLOW TO KIDNEYS

KIDNEYS RELEASE RENIN



Angiotensinogen is released by the LIVER

RENIN CONVERTS ANGIOTENSINOGEN INTO ANGIOTENSIN I

Angiotensin converting enzyme is released by the LUNGS

ANGIOTENSIN I IS CONVERTED TO ANGIONTENSIN II BY ANGIOTENSIN CONVERTING ENZYME

↑NA & WATER REABSORPTION

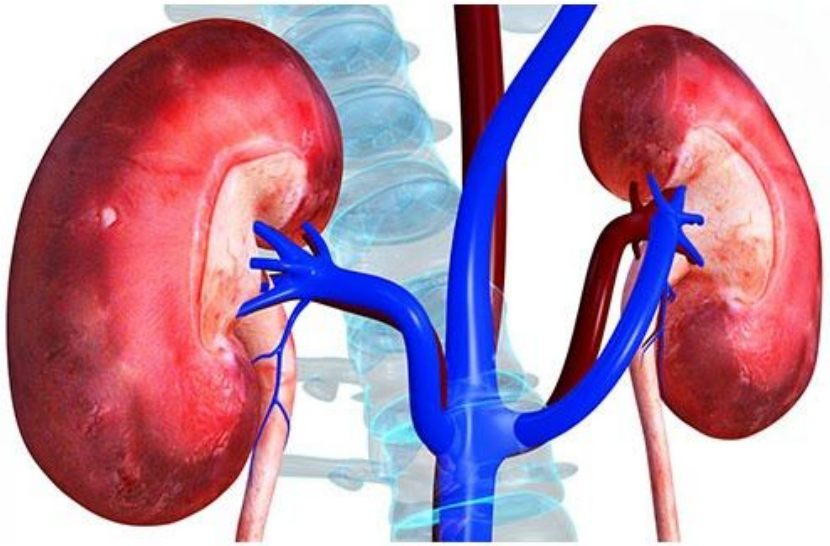
VASOCONSTRICTION

ALDOSTERONE RELEASE

↑SODIUM & FLUID RETENTION = VASOCONSTRICTION

↑BLOOD PRESSURE

ACUTE KIDNEY INJURY



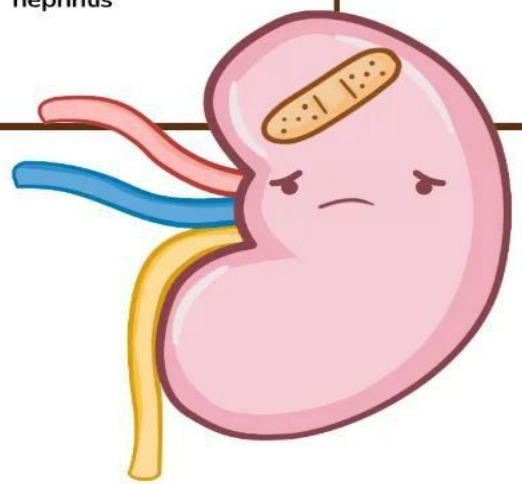
AKI : sudden deterioration of Renal Function .

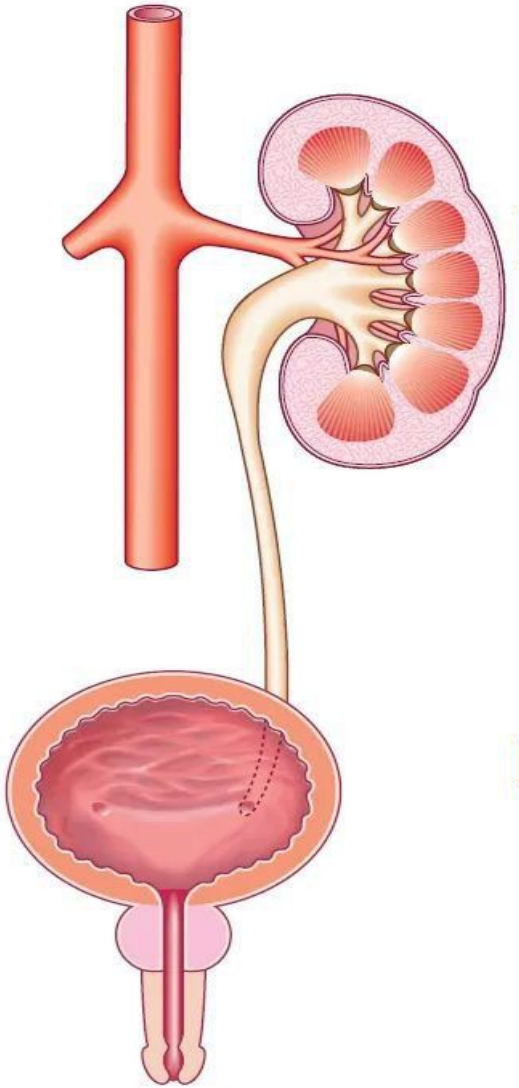
NEPHROTOXIC DRUGS

* Tetracyclines
* Streptomycin
* Vancomycin
* Gentamycin
* Acyclovir
* Acetaminophen
* Phenacetine
* NSAIDs
* Asprin
* Antihistamines,
* Phenobarbitones

ACUTE KIDNEY INJURY

TYPES of AKI	PRERENAL	INTRARENAL	POSTRENAL
MECHANISM	• Reduced blood flow to the kidneys	• Damage to kidney tubules, glomerulus, or interstitium	• Obstructed urine flow
CAUSES	• Hypovolemic states (hemorrhage, GI loss, renal loss, severe burns, sepsis) • Systolic heart failure • Hypoalbuminemia • Medications (NSAIDs, ACE-inhibitors, ARBs, Cyclosporine, & iodinated contrast	• Acute tubular necrosis • Nephrotoxins (aminoglycosides, methotrexate, lead, ethylene glycol, radiocontrast dye) • Rhabdomyelisis • Glomerular disease • Acute insterstitial nephritis	• Kidney stones • Benign prostatic hyperplasia • Prostatic cancer • Intra-abdominal tumors





PRE-RENAL

Impaired perfusion:
- Cardiac failure
- Sepsis
- Blood loss
- Dehydration
- Vascular occlusion

RENAL

Glomerulonephritis
Small-vessel vasculitis
Acute tubular necrosis
- Drugs
- Toxins
- Prolonged hypotension

Interstitial nephritis
- Drugs
- Toxins
- Inflammatory disease
- Infection

POST-RENAL

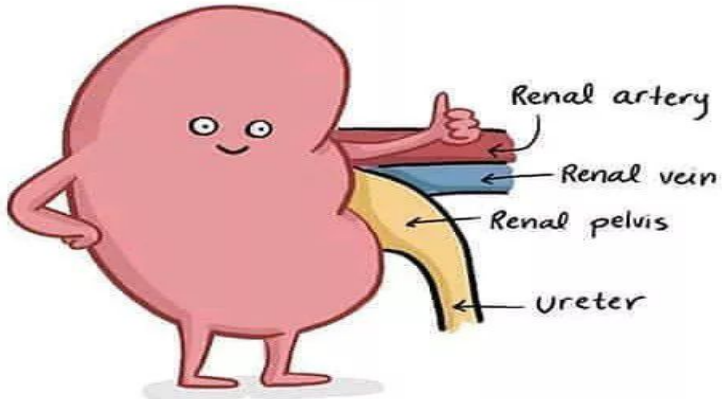
Urinary calculi
Retroperitoneal fibrosis
Benign prostatic enlargement
Prostate cancer
Cervical cancer
Urethral stricture/valves
Meatal stenosis/phimosis

Causes of acute kidney injury.

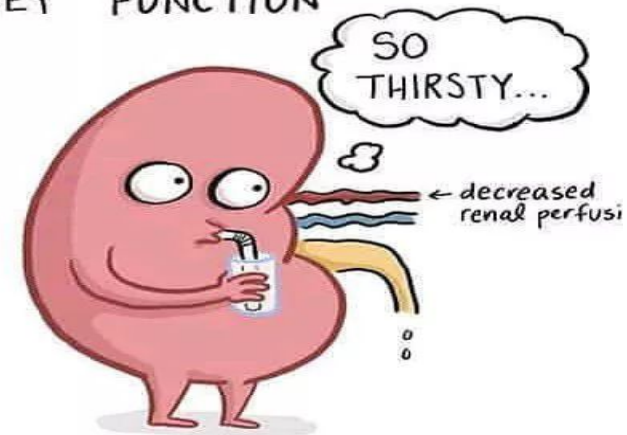
Source : Davidsons Essentials of Medicine, 2e

ACUTE KIDNEY INJURY

SUDDEN DECREASE IN KIDNEY FUNCTION



NORMAL



PRENAL

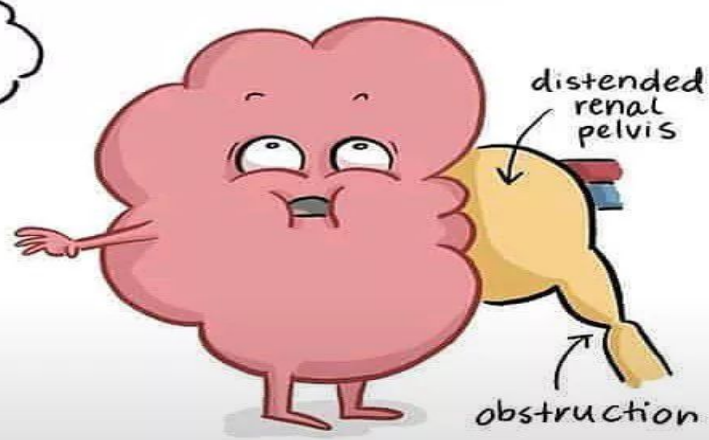
DECREASED BLOODFLOW TO KIDNEYS

(e.g. hemorrhage, hypovolemia, heart failure,...)

INTRINSIC

DISEASE WITHIN KIDNEY

(e.g. acute tubular necrosis, inflammation, toxicity,...)



POST-RENAL

URINARY OUTFLOW OBSTRUCTION

(e.g. Kidney stones, BPH, tumors, surgery, ...)

ACUTE KIDNEY INJURY (AKI)

- SIGNS & SYMPTOMS -

Oliguric Phase

- Oliguria - <400mL/day; occurs within 1-7 days of kidney injury
- Urinalysis – casts, RBCs, WBCs, sp gr fixated at 1.010
- Metabolic Acidosis
- Hyperkalemia and Hyponatremia
- Elevated BUN and Creatinine
- Fatigue & Malaise

Diuretic Phase

- Gradual ↑ in urine output - 1-3 L/day; may reach 3-5 L/day
- Hypovolemia, Dehydration
- Hypotension
- BUN and Creatinine Levels Begin to Normalize

Recovery Phase

- Begins when GFR Increases
- BUN and Creatinine Levels Plateau, then ↓

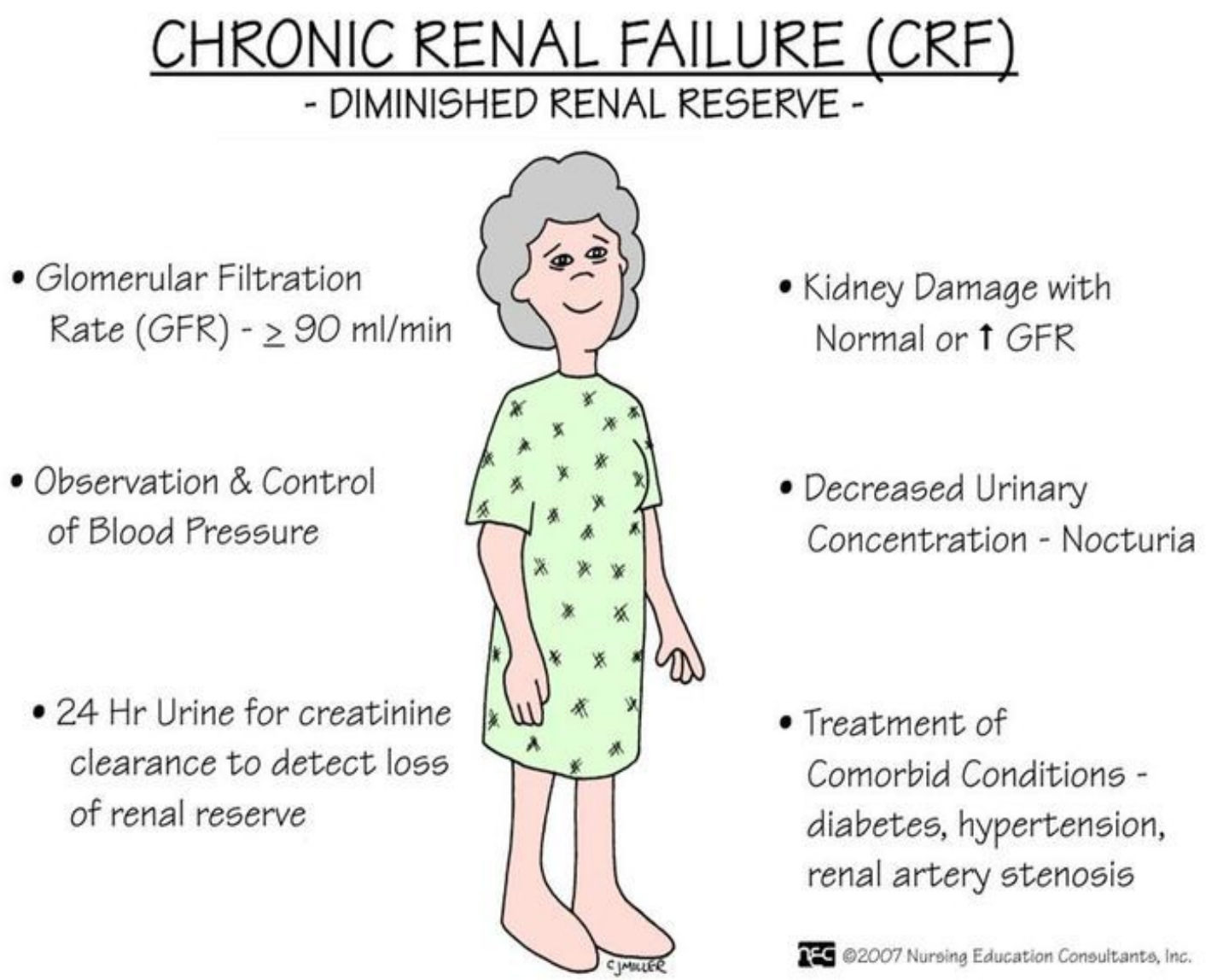
Signs & Symptoms

- Decreased urine output
- Dry mucous membranes
- Thirst
- Dizziness
- Peripheral oedema
- Increased creatinine
- Increased JVP

CKD

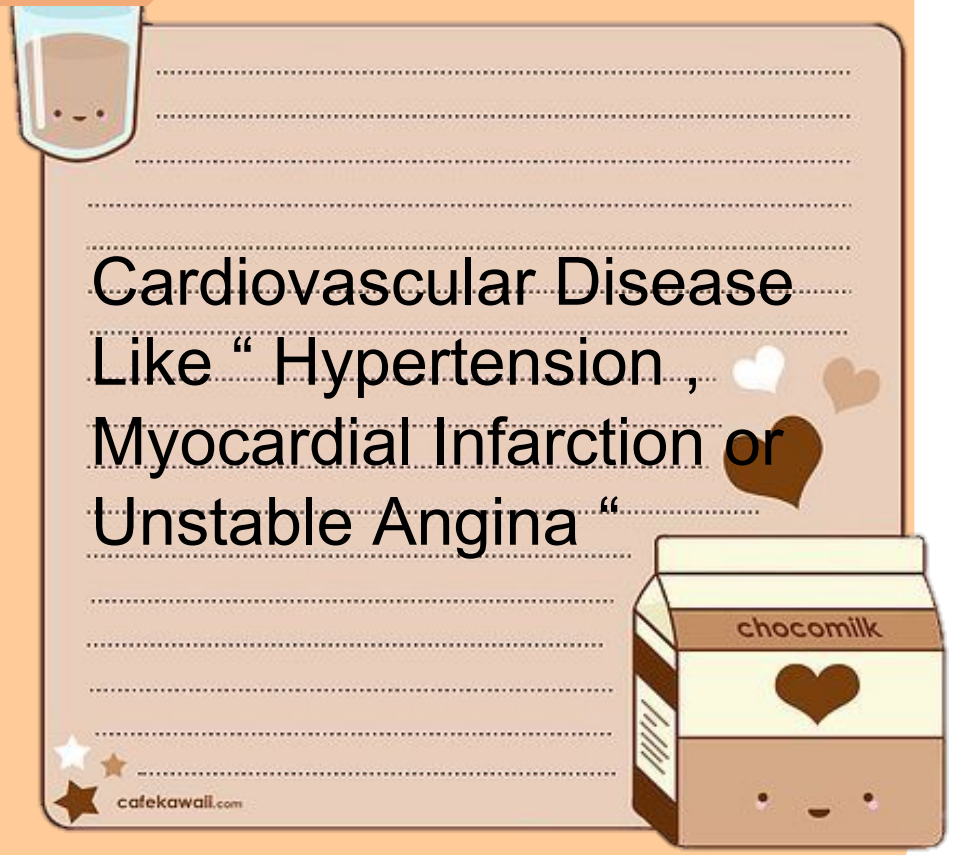
- Any Renal Impairment In The Kidney Function > 3 months this is CKD and Its irreversible condition leads to Kidney function .

- Most Common Cause of CKD is Diabetes Mellitus “ DM “ .



Clinical Note

Most Common Causes Of Death In CKD Pt. ?



Diagnosis Of " AKI and CKD "

AKI:

- **B**lood tests to measure waste product levels in the blood and assess kidney function.
- They also examine urine to check for abnormalities.
- In some cases, imaging tests like ultrasounds or CT scans might be necessary.

CKD:

- CKD is diagnosed based on a person's estimated glomerular filtration rate (eGFR), a measure of how well the kidneys are filtering blood. The eGFR is calculated from creatinine levels in the blood. An eGFR lower than 60 mL/min for more than three months indicates CKD.
- Urine tests are also conducted to check for proteinuria (an abnormal amount of protein in the urine).
- Imaging tests like an ultrasound may be needed.

“ Treatment Approaches for AKI and CKD “

Treating AKI involves :-

- ✔ Addressing the underlying cause.
- ✔ If dehydration is the issue, rehydration through intravenous fluids is necessary.
- ✔ If certain medications are causing harm, discontinuing them might help.
- ✔ **In severe cases,** hospitalization and dialysis, a treatment that replicates kidney function, may be needed.

Managing CKD :-

- ✔ Focuses on slowing its progression and managing underlying health conditions .
- ✔ Controlling blood pressure and blood sugar levels through medications can help preserve kidney function.
- ✔ A kidney-friendly diet that restricts salt, saturated fat, and processed foods while emphasizing fruits, vegetables, and whole grains can be beneficial.
- ✔ In severe cases, when kidneys are no longer functioning adequately, dialysis or a kidney transplant may become necessary.

Acute Kidney Injury (AKI) vs. Chronic Kidney Disease (CKD)

AKI

Sudden onset

Reversible if treated promptly

Causes: Dehydration, shock, nephrotoxic drugs

VS

CKD

Gradual onset over months/years

Irreversible, progressive

Causes: Diabetes, hypertension, glomerulonephritis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