RENAL FAILURE OR RENAL INSUFFICIENCY

Loss of Kidney Function → Filteration of blood

RENAL DISEASES :-

1. **Glomerular dis.** - These are often Immunologically - mediated & may be Acute or chronic.
2. **Tubular dis.** - These are mostly caused by toxic or infectious agent & are often acute.
3. **Interstitial dis.** → "Tubulo-interstitial disease" due to toxic/infectious agents.
4. **Vascular Disease** - These include changes in the nephron as a consequences of increased intra-glomerular pressure such as impaired blood flow or hypertension

These pathological condition may lead to →

1. Acute Renal Failure (ARF) or Acute Kidney Injury (AKI)
2. Chronic Renal Failure (CRF) or Chronic kidney dis. (CKD)
3. Acute-on-chronic Renal Failure (AoCRF)

CHARECTERIZER BY -

"Azotaemia" → ↑ Blood Urea Nitrogen (BUN) >30 mg/dL
↑ Creatinine >1.2 mg/dL

Normal Range :- BUN = 7-20 mg/dL
Creatinine = 0.6 - 1.2 mg/dL

Ratio = BUN : Cr = 12 to 20 (optimum - 15)

"Uraemia" = ↑ Urea level > 40 (20 - 40 mg/dL)

BUN/Cr
- Low → # Acute tubular nacrosis
  → # Low protein intake / Starvation
  → # Sever Liver Diseases
- High → # Pre Renal uremia
  # High Protein intake
  # After GI bleeding
- High with raised Cr - # Post Renal obstruction
  # Pre Renal uremia
  # Renal Disease

Symptoms of Renal Failure :→

↓ urine output
Peripheral Edema
Shortness of breath
drowsiness / Fatigue
Confusion
Seizures
Chest pain
Coma

Etiology of R.F.

1. Hypoperfusion at kidney → CVS disorders (HTN, HF), Liver failure, Dehydration, sever burn, Allergy, Sever infection, Inflammation
2. Urine Elimination problem → kidney stones, Enlarged prostate gland, blood clots at urinary tract, nerve damage that control Bladder (Para & Sympathetic neuron)
3. Others → Sever UTI, Overload of toxins & heavy metals, drugs, Alcohol, Lupus (Inflam. dis), Chemotherapy, Haemolytic uremic Syndrome

PC Pharmacology Concepts By Rajesh Choudhary

ACUTE RENAL FAILURE (ARF/AKI)

ARF is a rapid progressive loss of Renal funct^{n} that is characterized by → oligourea (<400 ml/day, in adult), Fluid & Electrolyte imbalance and sudden ↑ in metabolic waste in blood (urea & Creatinine) with consequent development of Uremia & Azotemia

ETIOPATHOGENESIS :-

1. Pre Renal ARF :- 20-25% Cases, Occurs due to sudden decreases in blood flow to nephron (Renal Ischemia) that lead to functional disorder and/or ↓ GFR.

Heart Failure (↓CO) # Hypovolemia # Vascular dis.
Fluid Sequestration in Liver Failure

R. Ischemia / R. Hypoxia → ↓GFR → ↓ Urine → R. injury → AKI (ARF) — CKD (CRF)

Therapy :- Improve Renal perfusion & Fluid infusion

2. Intrinsic/Intra Renal ARF :- 60-70% cases, occurs due to Intra Renal disease,- Acute Tubular nacrosis (ATN, 45%), caused by R. Ischemia, Renal Vascular dis., Glomerular disease & sever infections & toxins.

Renal Injury → Functional Disorders → ARF → CRF

3. Post-Renal ARF :- 10% Cases, Occurs due to obstruction of Renal tract (distal to collecting duct) & lower UT (Ureter, bladder neck, urethra)

Blood Clots # Stones # Fungus balls
tumour # Retroperitoneal Fibrosis

Clinical Manifestation / Outcome :-

Renal Failure

- ↑ Na^{+}/Wate Retention → HTN → Heart Failure / Edema
- ↑ Vascular Volume → Heart Failure / Edema
- (+) RAAS → CVS Remodeling & Oxidative Stress
- ↑ K^{+} → Hyperkalemia
- ↓ Elm. of N_2 Wastage ⇒ Uremia → Pericarditis, skin disorders, GI disturbance, Neurological disturbance, Sexual dysfunction
- Uremia → Coagulopathies
- ↓ Erythropoetin → Anaemia
- Acid Base Imbalance → Acidosis
- Acid Base Imbalance → Skeletal Buffering → Osteodystrophies
- Activat^{n} of Vit D → Osteodystrophies
- PO_4^{3-} Elm. → Hypocalcemia → Hyperparathyroidism

ARF Clinical course

1. **Initiating Phase -** Onset on events until tubular injury
2. **Maintenance phase** – ↓GFR, ↑Retention of metabolites (urea, Creatinine, ions), Edema, → HTN, Uremia → → Neuromuscular irritability → Seizure → Coma → death
3. **Recovery phase** → "Repair of Renal tissue"

Diuresis → → Electrolyte & Metabolic Balance → Healing (1 Year)

CHRONIC RENAL FAILURE / CHRONIC KIDNEY DISEASE

CRF/CKD is a progressive & irreversible damage of kidney structure (nephrons) that greatly reduce Renal function & marked decrease in GFR

R. Insufficiency, GFR - 50% - 20%
R. Failure, GFR - 20% - 5%
End stage Renal disease - GFR - < 5%

ETIOPATHOGENESIS :→ chronic Nephropathies → CRF

1. Disease Causing Glomerular Pathology :→

Glomerular dis. lead to CRF by immune mechanism

Glom. Destruct^{n} → Alterat^{n} in Fiteration process

Proteinuria, Hypoalbuminaemia ← Nephrotic Syndrome ⇓ and Oedema.

Ⓐ Primary G. Pathology - "chronic Glomerulonephritis"

Ⓑ Systemic G. Pathology - Originated from outside that can lead to change in nephrone secondarily.

e.g.- Diabetic nephropathy, serum sickness nephritis, and Lupus erythematous.

2. Disease Causing Tubulo-interstitial Pathology -

Tubulo-interstitial tissue Damage → Alteration in Tubular Reabsorption & Secretion ⇓

Excretion of large volume of diluted urine

Ⓐ Vascular Causes - Hypertension → Nephrosclerosis (Renal vessels occlusion) → R. Ischemia → Tub. damage

Ⓑ Infection Causes - "Pyelonephritis (upper UTI)

Ⓒ Toxic Causes - large dose/chronic uses of NSAIDs (Aspirine, phenacetin, Acetaminophen), Aminoglycoside and elements - lead, Cadmium, Uranium

Ⓓ Obstructive Causes :- chronic obstruction of U.T. lead to nephron damage due to Fluid back Pressure

e.g., - Stones, blood clots, tumours, etc

PROGRESSIVE STAGES -

I. Decreased Renal Reserved :- Marginal damage, GFR (50%), BUN, Creatinine - Normal level

II Renal Insufficiency - 75% damage of Renal tissue GFR (25%), ↑ BUN & Cr, Polyurea, Uraemic Syndrome

III Renal Failure - 90% damage, GFR (10%), ↑ Na^{+}/water, edema, Met. Acidosis, Hypocalcaemia & sign of Uraemia

IV End-Stage Renal Dis. (ESRD) or CKD - 99% damage, GFR (< 5%), Uraemic Syndrome, P^{o} (Renal) and Secondary (Extra Renal) Symptoms

TREATMENTS - (I) Dialysis
(II) Kidney Transplantation

» Adjuvent therapy to control etiological Condition