

CHRONIC KIDNEY DISEASE (CKD)

1. DEFINITION

Chronic Kidney Disease (CKD) is a progressive, irreversible decline in kidney function lasting **≥3 months**, characterized by:

- **Glomerular filtration rate (GFR) <60 mL/min/1.73 m² OR**
- **Kidney damage** (e.g., albuminuria, abnormal urine sediment, structural abnormalities)

CKD can progress to **end-stage renal disease (ESRD)**, requiring **dialysis or kidney transplantation**.

2. RISK FACTORS

Non-Modifiable Risk Factors

- Age >60 years
- Family history of CKD
- Genetic disorders (e.g., polycystic kidney disease)
- Low birth weight

Modifiable Risk Factors

- Diabetes mellitus (most common cause)
 - Hypertension (second most common cause)
 - Cardiovascular disease
 - Obesity and metabolic syndrome
 - Smoking
 - Nephrotoxic drugs (NSAIDs, aminoglycosides, contrast agents)
 - Recurrent kidney infections (pyelonephritis)
 - Glomerulonephritis
 - Autoimmune diseases (e.g., lupus nephritis, vasculitis)
 - Urinary tract obstructions (stones, tumors, BPH)
-

3. CAUSES

1. Diabetic Nephropathy (Most Common Cause, ~40%)

- Hyperglycemia damages glomeruli, leading to proteinuria and renal failure.

2. Hypertensive Nephrosclerosis

- Chronic high blood pressure causes kidney scarring (glomerulosclerosis).

3. Glomerular Diseases

- **Glomerulonephritis** (autoimmune, post-infectious, IgA nephropathy)
- **Lupus nephritis**
- **Amyloidosis**

4. Polycystic Kidney Disease (PKD)

- Genetic disorder causing cyst formation and kidney enlargement.

5. Chronic Urinary Tract Obstruction

- Kidney stones, BPH, tumors, or congenital abnormalities.

6. Recurrent Infections

- Chronic pyelonephritis due to repeated UTIs.

4. STAGES OF CKD (BASED ON GFR, ML/MIN/1.73 M²)

Stage	GFR (mL/min/1.73 m ²)	Description
1	≥90	Kidney damage with normal GFR (asymptomatic)
2	60-89	Mild decrease in GFR
3a	45-59	Moderate CKD (may have mild symptoms)
3b	30-44	Moderate to severe CKD
4	15-29	Severe CKD (preparing for dialysis/transplant)
5 (ESRD)	<15	Kidney failure (requires dialysis or transplant)

5. SYMPTOMS AND SIGNS

Early Stages (Stages 1–3)

- Often **asymptomatic**
- Fatigue, weakness
- Mild **hypertension**

Late Stages (Stages 4–5)

- **Uremic symptoms:**
 - Nausea, vomiting, loss of appetite
 - Metallic taste in mouth
 - Pruritus (itching)

- **Fluid overload:**
 - Edema (legs, face)
 - Pulmonary edema (dyspnea)
 - **Electrolyte imbalances:**
 - Hyperkalemia (arrhythmias)
 - Metabolic acidosis (Kussmaul breathing)
 - **Neurological symptoms:**
 - Confusion, drowsiness, coma (uremic encephalopathy)
 - Restless leg syndrome, neuropathy
-

6. COMPLICATIONS

1. Cardiovascular Complications

- **Hypertension** (due to fluid retention, RAAS activation)
- **Heart failure** (volume overload)
- **Arrhythmias** (due to hyperkalemia)

2. Electrolyte and Metabolic Imbalances

- **Hyperkalemia** → life-threatening arrhythmias
- **Metabolic acidosis**
- **Hyperphosphatemia** → secondary hyperparathyroidism
- **Hypocalcemia** → bone disease (renal osteodystrophy)

3. Hematologic Complications

- **Anemia (↓ Erythropoietin)** → fatigue, pallor
- **Bleeding tendency** (platelet dysfunction)

4. Bone and Mineral Disorders

- **Renal osteodystrophy** → osteoporosis, fractures
- **Secondary hyperparathyroidism**

5. Uremic Symptoms

- **Encephalopathy** → confusion, seizures
- **Uremic pericarditi**

7. INVESTIGATIONS AND FINDINGS

Laboratory Tests

- Serum Creatinine & eGFR → ↓ GFR
- BUN (Blood Urea Nitrogen) → ↑ in uremia
- Electrolytes:
 - ↑ K⁺ (Hyperkalemia)
 - ↓ HCO₃⁻ (Metabolic acidosis)
 - ↑ PO₄³⁻ (Hyperphosphatemia)
 - ↓ Ca²⁺ (Hypocalcemia)
- Complete Blood Count (CBC) → Anemia (low Hb, low RBCs)
- Parathyroid Hormone (PTH) → ↑ (Secondary hyperparathyroidism)

Urinalysis

- Proteinuria (albuminuria >30 mg/day)
- Broad waxy casts (indicative of CKD)
- Hematuria (in glomerulonephritis)

Imaging

- **Renal ultrasound:**
 - Small, shrunken kidneys (CKD)
 - Enlarged kidneys (Polycystic kidney disease, diabetic nephropathy)

8. MANAGEMENT

1. General Measures (Slow Progression)

- Blood pressure control (<130/80 mmHg) → ACE inhibitors (lisinopril, enalapril) or ARBs
- Glycemic control (HbA1c <7%) in diabetics
- Dietary modifications:
 - Low salt, low potassium, low phosphate diet
 - Protein restriction (avoid excess but prevent malnutrition)
 - Limit fluid intake in advanced CKD
- Avoid nephrotoxic drugs (NSAIDs, contrast agents)

2. Treatment of Complications

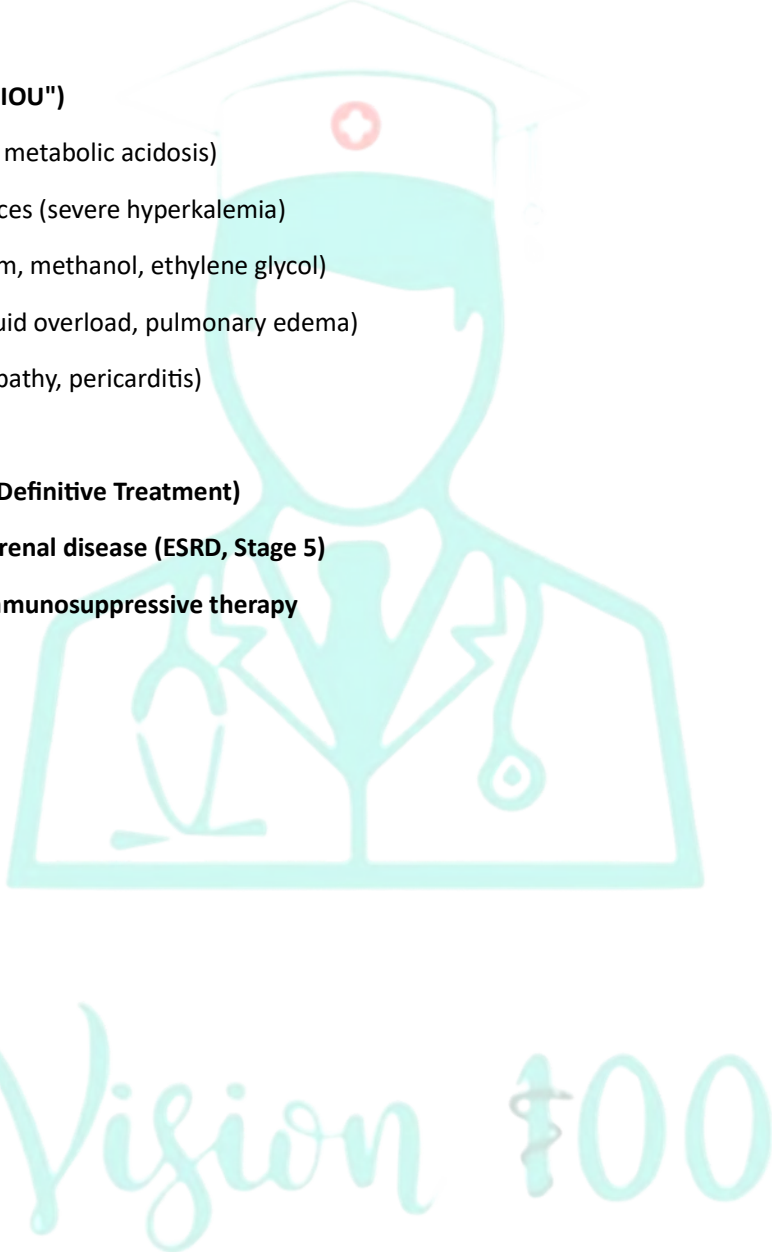
- **Hyperkalemia** → Sodium polystyrene sulfonate, calcium gluconate, insulin + dextrose
- **Acidosis** → Sodium bicarbonate supplements
- **Anemia** → Erythropoietin (EPO) + iron supplements
- **Bone disease** → Phosphate binders (calcium acetate, sevelamer), vitamin D supplements

3. Dialysis (Indications: "AEIOU")

- **Acidosis** (refractory metabolic acidosis)
- **Electrolyte imbalances** (severe hyperkalemia)
- **Intoxications** (lithium, methanol, ethylene glycol)
- **Overload** (severe fluid overload, pulmonary edema)
- **Uremia** (encephalopathy, pericarditis)

4. Kidney Transplantation (Definitive Treatment)

- Ideal for **end-stage renal disease (ESRD, Stage 5)**
- Requires lifelong **immunosuppressive therapy**



Vision 100