Chronic Kidney Disease

Definition of CKD

- Duration of >3months plus either:
  a. Kidney Damage evidenced by:
     - Albuminuria: UACR > 30mg/g
     - Structural abnormality: tumors, scarring, cysts
     - Pathological abnormality (evidence of pathology based on biopsy)
  b. Decreased Kidney Function: eGFR < 60mL/min/1.73 m2

GFR (mL/min/1.73 m²)	A1 <30 mg/g (Normal/Mild)	A2 30–300 mg/g (Moderate)	A3 >300 mg/g (Severe)
G1 (≥90)	🟢 Low risk	🟡 Moderate risk	🟠 High risk
G2 (60–89)	🟢 Low risk	🟡 Moderate risk	🟠 High risk
G3a (45–59)	🟡 Moderate risk	🟠 High risk	🔴 Very high risk
G3b (30–44)	🟠 High risk	🔴 Very high risk	🔴 Very high risk
G4 (15–29)	🔴 Very high risk	🔴 Very high risk	🔴 Kidney failure risk
G5 (<15)	🔴 Kidney failure risk	🔴 Kidney failure risk	🔴 Kidney failure risk

Common Causes of CKD

- Diabetes
- Hypertension
- Glomerulonephritis
- Interstitial nephritis
- Polycystic kidney disease or other inherited kidney diseases
- Prolonged obstruction of the urinary tract, from conditions such as enlarged prostate, kidney stones and some cancers
- Vesicoureteral reflux
- Recurrent kidney infection (pyelonephritis)

CKD: Holistic Approach

- **Lifestyle:** Healthy diet, Exercise, Weight management, Avoid tobacco
- **First Line Rx** for most patients: SGLT2i†‡ + SBP goal < 120* (at max tolerated ACE/ARB‡ dose); statin: moderate to high dose
- **Targeted Rx based on complications**
  - DM
    - May consider GLP-1
    - ns-MRA†‡ if needed for BP goal or if albuminuria persists
  - HTN
    - After ACE/ARB‡ then CCB and/or diuretic followed by MRA if eGFR ≥ 45
  - ASCVD high risk
    - Antiplatelet
    - Consider ezetimibe, PCSK9i (see CAD protocol for full list)

†ns-MRA: non-steroidal Mineralocorticoid: finerenone (hold finerenone if Potassium rises over 5.5mmol/l)
† Empagliflozin can be started down to an eGFR ≥ 20 ml/min (but once initiated, it is reasonable to continue even if eGFR falls below 20 ml/min)
‡ Expect <30% drop in eGFR after starting ACE/ARB, finerenone, or SGLT2i in the short term. If > 30% then need to hold & evaluate cause

When to Refer

- eGFR <30 mL/min/1.73 m².
- Rapid progression (>5 mL/min/1.73 m² decline in eGFR in 12 months).
- Persistent albuminuria (ACR >300 mg/g) despite therapy.
- Refractory hypertension or hyperkalemia despite management.
- https://www.kidneyfailurerisk.com/

Medication	T2D + CKD + Albuminuria	CKD + Albuminuria (No DM)	CKD Alone
RASi (ACEi/ARB)	First-line	First-line	May be used if hypertension or proteinuria
SGLT2i	Strongly recommended	Recommended if albuminuria ≥200 mg/g	May be considered if eGFR ≥20
MRA (nsMRA or sMRA)	Add if albuminuria persists despite RASi + SGLT2i; prefer nsMRA	Not recommended for non-diabetic CKD (nsMRA); sMRA can be used for resistant HTN	Not routinely used
GLP-1 RA	Consider if additional glycemic or cardiovascular benefit is needed	Not recommended yet	Not recommended yet

Cystatin C vs Creatinine for eGFR

Feature	Creatinine-Based eGFR	Cystatin C-Based eGFR
Source	Muscle metabolism	Produced by all nucleated cells
Affected by Muscle Mass?	Yes (higher in people with more muscle mass)	No (more stable across body types)
Affected by Diet?	Yes (high-protein diet, creatine supplements affect levels)	No (not influenced by diet)
Affected by Inflammation?	No	Yes (elevated in inflammatory states, obesity, thyroid dysfunction)
Cost & Availability	Inexpensive, widely available	More expensive, less commonly tested
Guideline Preference?	Default for most eGFR equations (e.g., CKD-EPI)	KDIGO recommends combined Creatinine + Cystatin C for better accuracy

Reference: KDIGO 2024 Guidelines

Common Changes in Chronic Kidney Disease (CKD): Causes and Treatments

Change	Cause	Treatment
Anemia	Decreased erythropoietin (EPO) production by kidneys	Erythropoiesis-stimulating agents (ESAs), iron supplementation
Hyperparathyroidism	Reduced kidney function → phosphate retention, impaired vitamin D activation, hypocalcemia	Phosphate binders, vitamin D supplements, calcimimetics
Hypocalcemia	Impaired activation of vitamin D and phosphate retention	Calcium supplements, active vitamin D (calcitriol)
Hyperphosphatemia	Reduced kidney function → phosphate excretion impairment	Phosphate binders (e.g., calcium carbonate), dietary phosphate restriction
Fluid Retention (Edema)	Reduced sodium and water excretion due to impaired kidney function	Diuretics (e.g., furosemide), fluid restriction, sodium reduction
Hypertension	Sodium and water retention, impaired renin-angiotensin-aldosterone system regulation	Antihypertensives (ACE inhibitors, ARBs, diuretics)
Metabolic Acidosis	Reduced excretion of hydrogen ions, impaired bicarbonate reabsorption	Bicarbonate supplementation (e.g., sodium bicarbonate if HC03 <22)
Proteinuria	Glomerular damage allows proteins to leak into urine	ACE inhibitors, ARBs, dietary protein restriction
Hyperkalemia	Reduced potassium excretion due to impaired kidney function	Potassium binders, dietary potassium restriction, diuretics
Decreased Vitamin D Activation	Impaired conversion of vitamin D to its active form	Active vitamin D (calcitriol), calcium supplementation
Uremia (Azotemia)	Accumulation of nitrogenous waste products due to reduced GFR	Dialysis (in advanced cases), dietary protein restriction
Dyslipidemia	Altered lipid metabolism in CKD	Statins, lifestyle modifications (diet, exercise)
Bone Mineral Disorder (Renal Osteodystrophy)	Imbalance of calcium, phosphate, and PTH, vitamin D deficiency	Phosphate binders, calcium supplements, vitamin D, PTH-lowering agents (e.g., calcimimetics)
Hyperuricemia (High Uric Acid)	Impaired kidney function → reduced uric acid excretion, leading to elevated levels	Uric acid-lowering therapy (e.g., allopurinol), dietary modifications (reduce purines)* * Treatment indicated only if symptomatic

eGFR	Type of Care	Risk of Kidney Failure
≥60	Primary Care	≤ 3-5%
30-60	Transition from primary care to nephrology	≥ 3-5%
<30	Transition from nephrology to interprofessional care	≥ 10%
<20	Access and transplant planning	≥ 40%

Vaccines

- All routine vaccines plus pneumococcal vaccine

CKD Cautions

- Avoid NSAIDs
- Polypharmacy risk, avoid nephrotoxic agents
- Restrict sodium, potassium, phosphate, protein in later stage CKD (prefer plant based proteins)

Reference: KDIGO 2024 Guidelines