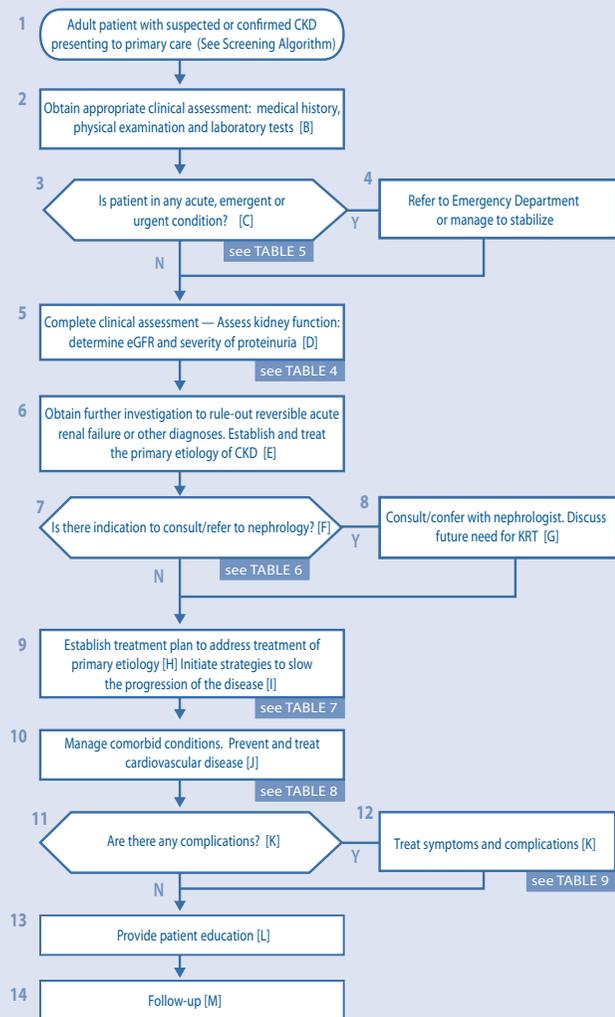


VA/DoD Clinical Practice Guideline Management of Chronic Kidney Disease

Treatment Algorithm



ACEI – Angiotensin-Converting Enzyme Inhibitor, ARB – Angiotensin II Receptor Blockers, DM – Diabetes Mellitus, eGFR – Estimated Glomerular Filtration Rate, KRT – Kidney Replacement Therapy

Dosing Recommendations for ACEIs and

ARBs in Patients with CKD^{a-c}

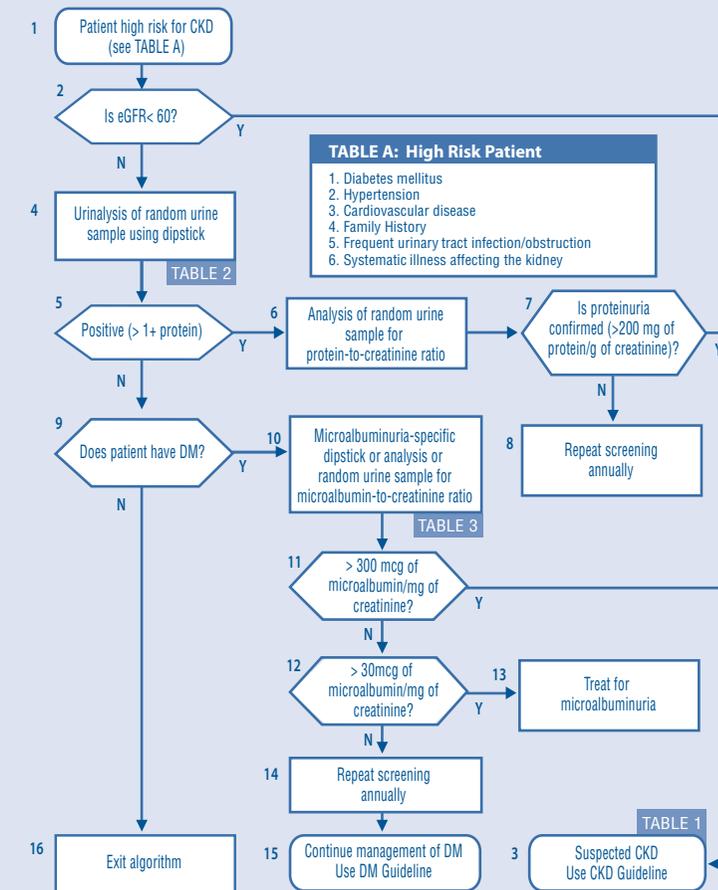
DRUG	USUAL DOSE RANGE	COMMENTS/CAUTIONS
Angiotensin Converting Enzyme Inhibitors (ACEIs)		
Benazepril	10 – 40 mg divided once or twice daily	<ul style="list-style-type: none"> Start with lower or less frequent doses in patients with renal insufficiency (except fosinopril as partial compensation by hepatobiliary elimination) or in patients currently being treated with a diuretic. Use with caution in patients with renal artery stenosis. Monitor potassium and renal function after initiation. Concomitant therapy with potassium-sparing diuretics and/or potassium supplements may result in hyperkalemia. Due to the potential risk for fetal morbidity and mortality in patients taking ACEIs during pregnancy, it is recommended that therapy be discontinued as soon as a woman becomes pregnant; alternate therapy should be considered. ACEIs should only be prescribed in pregnant women when the benefit clearly outweighs the potential risk for fetal abnormalities. Contraindicated in patients with a history of angioedema on an ACEI
Captopril ^d	25 – 150 mg divided two to three times daily	
Enalapril	5 – 40 mg divided once or twice daily	
Fosinopril	10 – 40 mg once daily	
Lisinopril	10 – 40 mg once daily	
Moexipril ^d	7.5 – 30 mg divided once or twice daily	
Perindopril	4 – 8 mg divided once or twice daily	
Quinapril	10 – 80 mg divided once or twice daily	
Ramipril	2.5 – 20 mg divided once or twice daily	
Trandolapril	1 – 4 mg once daily	
Angiotensin II Receptor Antagonists (ARBs)		
Candesartan	8 – 32 mg once daily	<ul style="list-style-type: none"> Alternative to ACEIs in patients unable to tolerate an ACEI. Consider lower doses in patients with intravascular volume depletion (e.g., patients currently being treated with a diuretic). Use with caution in patients with renal artery stenosis. Monitor potassium and renal function after initiation. Concomitant therapy with potassium-sparing diuretics and/or potassium supplements may result in hyperkalemia. Contraindicated in 2nd and 3rd trimesters of pregnancy due to potential neonatal/fetal morbidity and death. Use with caution in patients with a history of angioedema on an ACEI.
Eprosartan	400 – 800 mg divided once or twice daily	
Irbesartan	150 – 300 mg once daily	
Losartan	50 – 100 mg divided once or twice daily	
Olmesartan	20 – 40 mg once daily	
Telmisartan	40 – 80 mg once daily	
Valsartan	80 – 320 mg once daily	

Refer to www.pbm.va.gov or <http://vawww.pbm.va.gov> for a current list of medications on the One VA National Formulary

- Adapted from KDOQI Clinical Practice Guidelines on Hypertension and Antihypertensive Agents in Chronic Kidney Disease. Guideline 11: Use of angiotensin-converting enzyme inhibitors and angiotensin receptor blockers in CKD at http://www.kidney.org/professionals/kdoqi/guidelines_bp/guide_11.htm
- Adapted from McEvoy GK, ed. American Hospital Formulary Service Drug Information, Bethesda, MD: American Society of Health-System Pharmacists, Inc., 2006.
- Adapted from Hebel SK ed. Drug Facts and Comparisons, St. Louis, Missouri: Facts and Comparisons Inc., May 2006.
- One hour before meals, on an empty stomach

VA/DoD Clinical Practice Guideline Management of Chronic Kidney Disease

Screening Algorithm



VA access to full guideline: <http://www.healthquality.va.gov>
DoD access to full guideline: <https://www.QMO.amcdd.army.mil>
Sponsored & produced by the VA Employee Education System in cooperation with the Offices of Quality & Performance and Patient Care Services and the Department of Defense.

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TABLE 1 | Definitions of Chronic Kidney Disease

- Persistent decreased eGFR < 60 ml/min/1.73m² on two tests at least three months apart
- or
- Proteinuria (> 1+) on dipstick or urine protein-to-creatinine ratio > 0.2, confirmed on two tests at least three months apart
- or
- Microalbuminuria defined as albumin-to-creatinine ratio > 30, confirmed on two out of three urine tests in patients with diabetes mellitus (DM)
- or
- Known structural kidney disease defined by imaging or pathologic examination (e.g., polycystic kidney disease [PCKD])

Estimated glomerular filtration rate (eGFR) is the preferred method to assess kidney function.

TABLE 2 | Urine Dipstick: Interpretation

Protein	Blood	Consider
Negative	Negative	Rule-out false negative, microalbuminuria, multiple myeloma and other paraproteinuria, heart failure, volume depletion or obstruction, ischemic nephropathy
Positive	Negative	Rule-out false positive, benign, or orthostatic proteinuria, diabetes, HTN, tubulo-interstitial diseases, nephrotic syndrome. Quantitate proteinuria
Positive	Positive	UTI, pyelonephritis, RPGN, GN, HIV, vasculitis, pulmonary-kidney syndrome, HUS, TTP, malignant HTN, nephrotic syndrome, nephrolithiasis with obstruction, atypical DM, PCKD
Negative	Positive	Look for urologic cause of hematuria

Key: DM: Diabetes Mellitus; GN: Glomerulonephritis; HTN: Hypertension; HUS: Hemolytic Uremic Syndrome; PCKD: Polycystic Kidney Disease; RPGN: Rapidly Progressive Glomerulonephritis; TTP: Thrombotic Thrombocytopenic Purpura; UTI: Urinary Tract Infection

TABLE 3 | Definitions Of Abnormalities In Albumin Excretion

Condition	Random Urine for ALB-to-Cr Ratio (mg/g creatinine)
Normal	< 30
Microalbuminuria	30-300
Macroalbuminuria	> 300

TABLE 4 | Stages of Chronic Kidney Disease

Stage	eGFR (ml/min/1.73m ²)	Description	Action
1	≥90	Kidney damage with normal or increased eGFR	Diagnosis and treatment of comorbid conditions, slow progression, CVD risk reduction
2	60-89	Kidney damage with mildly decreased eGFR	Estimating progression
3	30-59	Moderately decreased eGFR	Evaluating and treating complications
4	15-29	Severely decreased eGFR	Preparation for kidney replacement therapy
5	<15 or dialysis	Kidney failure	Replacement (if uremia present)

TABLE 5 | Urgent/Emergent Conditions

- Acute renal failure
- Fluid overload, especially pulmonary edema
- Hyperkalemia (potassium ≥ 6.0 mEq/L)
- Metabolic acidosis (bicarbonate ≤ 16 mEq/L)
- Pericarditis
- Encephalopathy
- Signs symptoms of uremia (nausea, vomiting, and anorexia)

TABLE 6 | Indications for Nephrology Referral/Consultation

- eGFR < 30 ml/min/1.73m²
- Rapid decline of eGFR
- Severe complications of CKD (e.g., recalcitrant anemia, calcium or phosphorus abnormalities)
- Nephrotic range proteinuria (> 3.5 grams/24 hours)
- Underlying cause of CKD is unclear after basic work-up
- Kidney biopsy is indicated
- Patient's level of disease exceeds the level of comfort of the primary care provider

TABLE 7 | Recommended Intake of Protein, Energy, and Minerals in CKD

Chronic Kidney Disease	Protein g/kg/day	Energy kcal/kg/day	Phosphorus mg/day	Sodium gr/day
Mild to Moderate (eGFR 25 – 60 ml/min/1.73m ²)	No restriction	No restriction	600 – 800	< 2 ^a
Advanced (eGFR < 25 ml/min/1.73m ²)	0.60–0.75 ^b	35 ^c	600–800 8 gr/kg ^d	< 2

- ^a If hypertensive edema or history of heart failure
^b With close supervision and frequent dietary counseling
^c 30 kcal/kg/day for individuals 60 years or older
^d Along with phosphate binders, as needed, if serum phosphorus >5.5 mg/dL

TABLE 8 | Strategies to Slow Progression

- Control hypertension
- Use ACEI or ARB
- Control hyperglycemia in patients with diabetes
- Avoid nephrotoxic drugs and adjust medication dosage as indicated
- Smoking cessation
- Control dyslipidemia

TABLE 9 | Prevent and Treat Complications

- | | |
|---|-----------------------------------|
| 1. Risk for Cardiovascular Disease | 6. Volume overload |
| 2. Disorders of potassium balance | 7. Disorders of nutrition |
| 3. Disorders of calcium and phosphate metabolism (bone mineral) | 8. Adjustment of medication doses |
| 4. Acid based abnormalities | 9. Immunization |
| 5. Hematologic abnormalities (anemia) | |

VA/DoD Clinical Practice Guideline Management of Chronic Kidney Disease

		Urine Results			
		Protein < 1 gr/day without hematuria	Protein 1-3 gr/day without hematuria	Protein > 1 gr/day with hematuria	Protein > 3 gr/day with or without hematuria
Blood Results	eGFR > 60	Reassess patient annually with eGFR and urine protein determination	Consider diabetic nephropathy. If confirmed: • Offer ACE inhibitor (or ARB if intolerant) unless contraindications • Treat HbA1c to target • Continue to monitor eGFR and urine protein excretion at least annually If diabetic nephropathy is unlikely, consider referral to a renal specialist.		
	eGFR 30-59	Manage according to recommendations for non-diabetic renal disease according to stage of disease. Consider one-time referral to a renal specialist			
	eGFR < 30	Refer to renal specialist			

Refer to renal specialist