Management of Chronic Kidney Disease

**Treatment Algorithm**

1. Obtain appropriate clinical assessment: medical history, physical examination and laboratory tests (B)

2. Complete clinical assessment — Assess kidney function: Obtain further investigation to rule-out reversible acute renal failure or other diagnoses. Establish and treat the primary etiology (H) Initiate strategies to slow the progression of the disease (I)

3. Is patient in any acute, emergent or urgent condition? (C)

4. Does the patient have DM? (Y/N)

5. Is the patient on any angiotensin or diuretic (Y/N)?

6. Are any complications? (Y/N)

7. Refer to Emergency Department or manage in primary office.

8. Can’t refer or manage in primary office — Consult/confer with nephrologist. Discuss future need for KRT (G)

9. Complete treatment plan: initiate treatment of primary etiology (K) Initiate treatment to slow the progression of the disease (I)

10. Follow up (I)

11. Refer to Pharmacists to discuss drug therapy (J)

12. Refer to Dietitian for nutritional management (J)

13. Provide patient education (L)

14. Follow up (L)

15. Make appropriate clinical assessment: medical history, physical examination and laboratory tests (B)

**Screening Algorithm**

1. **Suspected CKD**

2. Analysis of random urine sample for proteinuria? (Y/N)

3. Analysis of random urine sample for protein/g of creatinine? (Y/N)

4. Microalbumin/mg of creatinine? (Y/N)

5. Microalbumin-to-creatinine ratio? (Y/N)

6. Microalbumin/mg of urine? (Y/N)

7. Repeat screening annually (N)

8. Repeat screening every six months (Y)

9. Repeat screening every three months (Y)

10. Refer to Pharmacists to discuss drug therapy (J)

11. Repeat urinary screening every six months (Y)

12. Ask to monitor uric acid level every six months (Y)

13. Complete intervention to slow progression of CKD (I)

14. Use CKD Guideline Exit algorithm

**Dosing Recommendations for ACEIs and ARBs in Patients with CKD**

<table>
<thead>
<tr>
<th>DRUG</th>
<th>USUAL DOSE RANGE</th>
<th>COMMENTS/CAUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benazepril</td>
<td>10 – 40 mg divided once or twice daily</td>
<td>• Start with lower or less frequent doses in patients with renal insufficiency (except fosinopril as partial compensation by heparinability 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.</td>
</tr>
<tr>
<td>Captopril</td>
<td>25 – 150 mg divided two to three times daily</td>
<td>Concomitant therapy with potassium-sparing diuretics and/or potassium supplements may result in hyperkalemia.</td>
</tr>
<tr>
<td>Enalapril</td>
<td>5 – 40 mg divided once or twice daily</td>
<td>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. Alternating therapy should be considered. ACEIs should only be prescribed in pregnant women when the benefit clearly outweighs the potential risk for fetal abnormalities.</td>
</tr>
<tr>
<td>Fosinopril</td>
<td>10 – 40 mg once daily</td>
<td>• Concomitant therapy with potassium-sparing diuretics and/or potassium supplements may result in hyperkalemia.</td>
</tr>
<tr>
<td>Lisinopril</td>
<td>10 – 40 mg once daily</td>
<td>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. Alternating therapy should be considered. ACEIs should only be prescribed in pregnant women when the benefit clearly outweighs the potential risk for fetal abnormalities.</td>
</tr>
<tr>
<td>Moexipril</td>
<td>7.5 – 30 mg divided once or twice daily</td>
<td>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. Alternating therapy should be considered. ACEIs should only be prescribed in pregnant women when the benefit clearly outweighs the potential risk for fetal abnormalities.</td>
</tr>
<tr>
<td>Perindopril</td>
<td>4 – 8 mg divided once or twice daily</td>
<td>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. Alternating therapy should be considered. ACEIs should only be prescribed in pregnant women when the benefit clearly outweighs the potential risk for fetal abnormalities.</td>
</tr>
<tr>
<td>Quinapril</td>
<td>10 – 80 mg divided once or twice daily</td>
<td>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. Alternating therapy should be considered. ACEIs should only be prescribed in pregnant women when the benefit clearly outweighs the potential risk for fetal abnormalities.</td>
</tr>
<tr>
<td>Ramipril</td>
<td>2.5 – 20 mg divided once or twice daily</td>
<td>Concomitant therapy with potassium-sparing diuretics and/or potassium supplements may result in hyperkalemia.</td>
</tr>
<tr>
<td>Telmisartan</td>
<td>80 – 320 mg once daily</td>
<td>Use with caution in patients with a history of angioedema on an ACEI.</td>
</tr>
</tbody>
</table>
**TABLE 1 | Definitions of Chronic Kidney Disease**

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

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

**TABLE 2 | Urine Dipstick: Interpretation**

<table>
<thead>
<tr>
<th>Blood</th>
<th>Consider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>Negative Rule-out false negative, microalbuminuria, multiple myeloma and other paraproteinemia, heart failure, volume depletion or obstruction, ischemic nephropathy</td>
</tr>
<tr>
<td>Positive</td>
<td>Negative Rule-out false positive, benign, or orthostatic proteinuria, diabetes, HTN, tubulo-interstitial diseases, nephrotic syndrome. Quantitate proteinuria</td>
</tr>
<tr>
<td>Positive</td>
<td>Positive UTL, pyelonephritis, I/PN, GN, HV, vascultis, pulmonary-kidney syndrome, HUS, TTP, malignant HTN, nephrotic syndrome, nephrotolithiasis with obstruction, atypical DM, PKD</td>
</tr>
<tr>
<td>Negative</td>
<td>Positive Look for urologic cause of hematuria</td>
</tr>
</tbody>
</table>

**TABLE 3 | Definitions Of Abnormalities In Albumin Excretion**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Random Urea for A2R to Cr Ratio (mg/ml/creatinine)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>Microalbuminuria</td>
<td>10-300</td>
</tr>
<tr>
<td>Macroalbuminuria</td>
<td>&gt; 300</td>
</tr>
</tbody>
</table>

**TABLE 4 | Stages of Chronic Kidney Disease**

<table>
<thead>
<tr>
<th>Stage</th>
<th>eGFR (ml/min/1.73m²)</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&gt; 90</td>
<td>Kidney damage with normal or increased eGFR</td>
<td>Diagnosis and treatment of comorbid conditions, slow progression, CVD risk reduction</td>
</tr>
<tr>
<td>2</td>
<td>60-89</td>
<td>Kidney damage with mildly decreased eGFR</td>
<td>Estimating progression</td>
</tr>
<tr>
<td>3</td>
<td>30-59</td>
<td>Moderately decreased eGFR</td>
<td>Evaluating and treating complications</td>
</tr>
<tr>
<td>4</td>
<td>15-29</td>
<td>Severely decreased eGFR</td>
<td>Preparation for kidney replacement therapy</td>
</tr>
<tr>
<td>5</td>
<td>&lt; 15 or dialysis</td>
<td>Kidney failure</td>
<td>Replacement (if uremia present)</td>
</tr>
</tbody>
</table>

**TABLE 5 | Urgent/Emergent Conditions**

- **Acute renal failure**
- **Fluid overload, especially pulmonary edema**
- **Hyperkalemia (potassium > 6.5 mEq/L)**
- **Metabolic acidosis (bicarbonate ≤ 16 mEq/L)**
- **Hyperkalemia (potassium ≥ 6.0 mEq/L)**
- **Pericarditis**
- **Encephalopathy**
- **Signs symptoms of uremia (nausea, vomiting, and anorexia)**

**TABLE 6 | Indications for Nephrology Referral/Consultation**

- 1 g/day or < 30 ml/min/1.73m²
- Rapid decline of eGFR
- Severe complications of CKD (e.g., resistant arterial hypertension, hypercalcemia, acute kidney failure)
- 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**

<table>
<thead>
<tr>
<th>Protein</th>
<th>Energy</th>
<th>Phosphorus</th>
<th>Sodium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild to Moderate (eGFR 60 - 45 ml/min/1.73m²)</td>
<td>No restriction</td>
<td>No restriction</td>
<td>&lt; 2*</td>
</tr>
<tr>
<td>Advanced (eGFR &lt; 30 ml/min/1.73m²)</td>
<td>≤ 0.70*</td>
<td>≤ 0.70*</td>
<td>≤ 2*</td>
</tr>
</tbody>
</table>

* Hypertensive edema or history of heart failure
* With close supervision and frequent dietary counseling
* 30 kcal/kg/day for individuals 60 years or older
* Along with phosphate binders, as needed, if serum phosphorus > 5.5 mg/dL

**TABLE 8 | Strategies to Slow Progression**

1. Control hypertension
2. Use ACEI or ARB
3. Control hyperglycemia in patients with diabetes
4. Avoid nephrotoxic drugs and adjust medication dosage as indicated
5. Smoking cessation
6. Control dyslipidemia
7. Disorders of calcium and phosphate metabolism (bone mineral metabolism)
8. Disorders of potassium balance
9. Disorders of nutrition metabolism (liver, kidney, muscle)
10. Acute renal failure
11. Volume overload
12. Disorders of nutrition metabolism (liver, kidney, muscle)
13. Adjustments of medication dosage
14. Acid-based abnormalities
15. Hematologic abnormalities (anemia)

**TABLE 9 | Prevent and Treat Complications**

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

**VA/DoD Clinical Practice Guideline Management of Chronic Kidney Disease**

**Urine Results**

- Protein < 1 g/day without hematuria
- Protein < 1 g/day with hematuria
- Protein > 1 g/day with or without hematuria

**Blood Results**

- eGFR 30-59
- eGFR < 30
- eGFR > 60

**Refer to renal specialist**

**Random Urea for A2R**

- < 30 ml/min/1.73m²