# CARE GUIDE for Chronic Kidney Disease (CKD)

<table>
<thead>
<tr>
<th>SUGGESTED GUIDELINES</th>
<th>PROCESS</th>
<th>IMPORTANT FINDINGS, MEASUREMENTS AND VALUES</th>
<th>INTERVENTIONS</th>
<th>SUGGESTED FOLLOW-UP</th>
</tr>
</thead>
</table>
| Screening for and Diagnosis of Chronic Kidney Disease\(^{(1,24)}\) | • Screen all individuals that have: Clinical risk factors:  
  ➢ Diabetes (DM)  
  ➢ Hypertension (HTN)  
  ➢ Autoimmune diseases  
  ➢ Systemic infections  
  ➢ Urinary tract infections  
  ➢ Urinary stones  
  ➢ Lower urinary tract obstruction  
  ➢ Neoplasm  
  ➢ Family history of CKD  
  ➢ Recovery from acute kidney failure  
  ➢ Reduction in kidney mass  
  ➢ Exposure to certain drugs  
  ➢ Low birth weight  
  Socio-demographic or other risk factors:  
  ➢ Older age  
  ➢ U.S. ethnic minority status: African American, American Indian, Hispanic, | Criteria for CKD – either of the following present for >3 months:\(^{(1)}\)  
• Markers of kidney damage. One or more present:  
  ➢ Albuminuria  
  ➢ Urine sediment abnormalities  
  ➢ Electrolyte and other abnormalities due to tubular disorders  
  ➢ Abnormalities detected by histology  
  ➢ Structural abnormalities detected by imaging  
  ➢ History of kidney transplantation  
• Decreased Glomerular filtration rate (GFR)\(^{(1)}\) | • Test for markers of kidney damage  
• Positive screening: start management of chronic kidney disease per guidelines | • If normal, advise to decrease risk factor(s) and repeat evaluation annually  
• Dipstick (urine) for protein 1+ or greater should have a quantitative protein-to-creatinine ratio or albumin-to-creatinine ratio test within three months |
- Asian or Pacific Islander
  - Exposure to certain chemical and environmental conditions
  - Low income/education level that put individuals at increased risk for development of chronic kidney disease

Screen with:
- Urine dipstick test for protein, Red Blood Cell (RBC), White Blood Cell (WBC)
- Spot urine sample (if first morning specimen is unavailable) for albumin-to-creatinine or protein-to-creatinine ratio test

- GFR <60 ml/min/1.73 m$^2$ (GFR categories G3a-G5) $^{(1)}$

Susceptibility Risks:
- Older age
- Family history
- Reduction in kidney mass
- Low birth weight
- U.S. racial or ethnic minority status
- Low income/low education level

Direct Risks:
- Diabetes
- Hypertension
- Autoimmune disease
- Systemic infections
- Urinary tract infections, stones or obstructions
- Drug toxicity

Progression Risks:
- Higher level of proteinuria
- Higher blood pressure level
- Poor glycemic control in diabetes
- Smoking
| Monitoring for Kidney Function<sup>(1,24)</sup> | Kidney Disease Improving Global Outcomes (KDIGO) recommends:<sup>(1)</sup> | Identification of modifiable risk factors and initiation of appropriate interventions  
- Identification of complications and initiation of appropriate interventions  
- Education and preparation to cope with the stress of chronic kidney disease  
- Medication review each visit to identify drugs with adverse effects on kidney function, including non-steroidal anti-inflammatory drugs (NSAIDs)  
- Adjust drug dosage according to level of kidney function |  
- At least annually, more frequently in patients with:  
  - eGFR < 60 ml/min/1.73 m<sup>2</sup>  
  - Fast eGFR decline in the past 2 months (>4 ml/min/1.73m<sup>2</sup>)  
  - Risk factors for faster progression  
  - Ongoing treatment to slow progression  
  - Exposure to risk factors for eGFR decline  
    - Smoking  
    - HTN  
    - Obesity  
    - Hyperglycemia  
    - Hyperlipidemia  
    - Infection  
    - NSAIDs |

- Calculate the estimated Glomerular filtration rate (eGFR) by using prediction equations<sup>*</sup>  
- Adults: Modification of Diet in Renal Disease (MDRD or Cockroft-Gault equation  
- Children: Schwartz and Counahan-Barratt equations  
- Creatinine Clearance (CC) is useful in special situations (i.e., for vegetarians, for those individuals taking creatine supplements, in amputees, and in muscle wasting diseases)  
- + Dipstick (1+ or greater) for urine protein  
- ≥ 2 positive quantitative tests (1-2 weeks apart) demonstrate persistent proteinuria and require further evaluation  
- Kidney Disease Improving Global Outcomes (KDIGO) recommends:<sup>(1)</sup>  
  - CKD classified based on:<sup>(1)</sup>  
    - Cause  
    - GFR category, and  
    - Albuminuria category  
  - Assign cause of CKD based on:<sup>(1)</sup>  
    - presence or absence of systemic disease, and  
    - the location within the kidney of observed or presumed pathologic-anatomic findings  
  - CKD Stages:<sup>(1)</sup>  
    - Stage 1: eGFR ≥ 90 ml/min/1.73 m<sup>2</sup>. Normal or high kidney function
- Stage 2: eGFR 60-89 ml/min/1.73 m². Mildly decreased kidney function relative to young adult
- Stage 3a: eGFR 45-59 ml/min/1.73 m². Mild to moderately decreased kidney function
- Stage 3b: eGFR 30-44 ml/min/1.73 m². Moderately to severely decreased kidney function
- Stage 4: eGFR 15-29 ml/min/1.73 m². Severely decreased kidney function
- Stage 5: eGFR < 15 ml/min/1.73 m². Kidney failure

- Assign albuminuria categories. Urine reagent strip results can be substituted where albuminuria measurement is not available(1)
- A: AER <30 mg/24 hrs, Albumin-to-creatinine ratio (ACR) <30 mg/g.
## Blood Pressure (BP) Monitoring

<table>
<thead>
<tr>
<th>Measure BP at each visit</th>
<th>BP targets should be individualized according to: (23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Age</td>
<td>- Co-existing CVD</td>
</tr>
<tr>
<td>- Other comorbidities</td>
<td>- Risk of progression of CKD</td>
</tr>
<tr>
<td>- Presence or absence of retinopathy (in CKD patients with diabetes)</td>
<td>- Tolerance of treatment</td>
</tr>
</tbody>
</table>

### Goal

<table>
<thead>
<tr>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults ≤130/80 with chronic kidney disease or diabetes</td>
</tr>
<tr>
<td>2014 JNC 8 Guideline for the Management of High Blood Pressure in Adults recommends BP goal of &lt;140/90 for adults with chronic kidney disease (11)</td>
</tr>
</tbody>
</table>

### Therapeutic lifestyle changes (TLC): (2)

- **Diet** - KDIGO recommends lowering salt intake to <2 g per day, unless contraindicated
- **Weight reduction** - achieve or maintain a healthy weight (BMI 20-25)
- **Exercise program** that is compatible with cardiovascular health and tolerance, aiming for at least 30 minutes 5 times a week

### Monitor serum potassium and creatinine if taking an angiotensin-converting-enzyme-inhibitor (ACE-I), angiotensin receptor blocker (ARB) or diuretic

### Assess BP goal each visit

---

Normal to mildly increased

- **A2**: AER 30-300 mg/24 hrs. ACR 30-300 mg/g.

Moderately increased (relative to young adult level)

- **A3**: AER >300 mg/24 hrs, ACR >300 mg/g. Severely increased. Includes nephrotic syndrome (where albumin excretion usually >2200 mg/24 hours [ACR >2220 mg/g](1))

---

2015 CKD Care Guide Final 8.12.15

Healthways Medical Integrity

Copyright © 2004-2015 Healthways, Inc. All Rights Reserved
<table>
<thead>
<tr>
<th>Inquire about postural dizziness and check for postural hypotension regularly when treating CKD patients with BP-lowering medications&lt;sup&gt;(2)&lt;/sup&gt;</th>
<th>Limit alcohol consumption to no more than two standard drinks per day for men and no more than one standard drink per day for women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggressive blood pressure control is the mainstay of therapy in the early stages of CKD and has a proven effect in limiting the progression of the disease&lt;sup&gt;(22)&lt;/sup&gt;</td>
<td>Encourage home BP monitoring</td>
</tr>
</tbody>
</table>

Add pharmacological intervention to TLC if BP goal not reached with TLC alone

Clinical findings (Drug use sequence)

- CKD absence with or without proteinuria (diuretic, then angiotensin-converting-enzyme-inhibitor (ACE-I), angiotensin receptor blocker (ARB), beta blocker (BB) or calcium channel blocker (CCB))
- CKD with proteinuria (ACE-I, ARB, then diuretics, CCB or BB)
- Diabetes (ACE-I, ARB, then Thiazide (THIAZ), then BB or Non-dihydropyridine calcium channel blocker (non-DCCB))
- Post myocardial infarction (MI) (BB, ACE-I, ARB)
The prescribed drug regimen commonly involves many medications so it is reasonable to use strategies that might maximize the likelihood of adherence:(2)

- use of less expensive drugs,
- convenient frequency of dosing
- reduction in pill numbers

This can be achieved by:(2)

- prescribing once-daily medications, and,
- combination pills (which are simpler to take and in some circumstances may be less expensive than the individual agents) when possible

ACE-I should not be used in pregnancy, history of angioedema, cough due to ACE-I, or allergy to ACE-I or ARB(2)

ARB should not be used in pregnancy, allergy to ACE, ACE-I or ARB, or cough due to ARB(2)
### Neuropathy

- All patients with CKD
- Neuropathy is directly related to the level of kidney function and/or co-morbid conditions (e.g., diabetes, lupus, hepatic failure, amyloidosis)
- Assess for signs/symptoms of central and peripheral neurologic involvement
- Symptoms or indices of neuropathy may be useful to determine need to initiate dialysis
- If normal, reassess periodically
- If abnormal, consider appropriate neurological studies

### Lipid Management

- All adults with CKD should be considered in the "highest risk group" for cardiovascular disease and should be evaluated for dyslipidemias
- Measure fasting lipid profile in adults with newly identified CKD (including those on chronic dialysis or kidney transplantation). Dyslipidemia is common but not universal in people with CKD.
- Major determinants of dyslipidemia in CKD patients are:
  - GFR
  - Presence of diabetes
  - Severity of proteinuria
  - Use of immunosuppressive agents
  - Modality of renal replacement therapy [RRT] (treatment by
- Prior guidelines emphasized treatment escalation to achieve specific LDL-C targets by increasing the dose of statin and/or combination therapy
- With the lack of data to support this approach in populations with and without CKD, the substantial within-person variability in LDL-C measurements and the potential for medication-related toxicity, this approach is no longer recommended for CKD populations
- The focus of therapy is reduction of atherosclerotic cardiovascular disease (ASCVD) risk in those most likely to benefit
- Initiate Therapeutic Lifestyle Changes (TLC) for all patients
  - reduce saturated fats and cholesterol
  - reduce/eliminate trans fats
  - increase fiber intake
  - Increase omega-3 fatty acids
  - daily physical activity
  - weight management
  - avoid tobacco
- Drug therapy if low-density-lipoprotein-cholesterol (LDL-C) > 100 mg/dL
- Use statins as first-line drug therapy for high LDL
- If triglycerides > 500 mg/dL, treat with fibrate or niacin first
- In adults aged ≥50 years with eGFR < 60 ml/min/1.73 m² but not treated with chronic dialysis or
- Follow-up measurements of lipid levels should be reserved for instances where the results would alter management. Potential reasons to measure LDL-C in people with CKD after their initial assessment:
  - To assess adherence to statin treatment
  - Change in RRT modality or
  - Concern about the presence of new secondary causes of dyslipidemia, or
  - To assess 10-year cardiovascular risk in patients < 50 years and not currently receiving a statin
- Monitor liver function tests before treatment with statins and periodically thereafter to assess for drug toxicity
- Check package insert for dosing of statins when eGFR < 60 ml/min/ 1.73 m²
- Monitor Creatine Phosphokinase
<table>
<thead>
<tr>
<th>Low Density Lipoprotein (LDL) Cholesterol:</th>
<th>High Density Lipoprotein (HDL) Cholesterol:</th>
<th>Triglycerides (TG):</th>
</tr>
</thead>
<tbody>
<tr>
<td>• There are no specific value treatment targets for LDL-C</td>
<td>• ≥60mg/dL female&lt;sup&gt;(20)&lt;/sup&gt;</td>
<td>• &lt;150 mg/dL&lt;sup&gt;(20)&lt;/sup&gt;</td>
</tr>
<tr>
<td>• LDL-C values are used to assess treatment effectiveness and adherence</td>
<td>• ≥55mg/dL male&lt;sup&gt;(20)&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>• Optimal is &lt; 100 mg/dL&lt;sup&gt;(20)&lt;/sup&gt;</td>
<td>• Values below 40mg/dL are considered low for HDL&lt;sup&gt;(20)&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

**Kidney Transplantation:**

- In adults with CKD (including those treated with chronic dialysis or kidney transplantation), follow-up measurement of lipid levels is not required for the majority of patients.<sup>(19)</sup>

- Statin therapy reduces ASCVD risk in persons with baseline LDL-C levels >70 mg/dL.<sup>(21)</sup>

- High-intensity statin therapy reduces LDL-C approximately ≥50% from the untreated baseline.<sup>(21)</sup>

- Moderate-intensity statin therapy reduces LDL-C approximately 30% to <50% from the untreated baseline.<sup>(21)</sup>

**Statin Therapy:**

- Statin therapy reduces ASCVD risk in persons with baseline LDL-C levels >70 mg/dL.

- High-intensity statin therapy reduces LDL-C approximately ≥50% from the untreated baseline.<sup>(21)</sup>

- Statin therapy reduces ASCVD risk in persons with baseline LDL-C levels >70 mg/dL.

- High-intensity statin therapy reduces LDL-C approximately ≥50% from the untreated baseline.<sup>(21)</sup>

- Moderate-intensity statin therapy reduces LDL-C approximately 30% to <50% from the untreated baseline.<sup>(21)</sup>

**Low Density Lipoprotein (LDL) Cholesterol:**

- There are no specific value treatment targets for LDL-C.

- LDL-C values are used to assess treatment effectiveness and adherence.

- Optimal is < 100 mg/dL.<sup>(20)</sup>

**High Density Lipoprotein (HDL) Cholesterol:**

- ≥60mg/dL female<sup>(20)</sup>

- ≥55mg/dL male<sup>(20)</sup>

- Values below 40mg/dL are considered low for HDL<sup>(20)</sup>.

**Triglycerides (TG):**

- <150 mg/dL<sup>(20)</sup>

- <150 mg/dL<sup>(20)</sup>
### Anemia Screening

| **Anemia Screening**<sup>1,4,5,6,24</sup> | **Screen Hemoglobin (Hgb) in all CKD patients:**<sup>(1)</sup>  
- when clinically indicated in adults with CKD stages 1 and 2  
- At least annually in patients with CKD stage 3  
- At least twice per year in patients with CKD stages 4-5 Non-dialysis (ND)  
- At least every 3 months in patients with CKD stage 5 on Hemodialysis (HD) and CKD stage 5 on Peritoneal dialysis (PD)  
- Anemia work-up should include: | **Diagnosis of anemia in adults:**<sup>(6)</sup>  
- Hgb < 13.0 gm/dL in males  
- Hgb < 12.0 gm/dL in females | **Rule out other cause of anemia**  
- If iron deficiency is identified, treat with iron supplements  
- Consider intravenous (IV) iron therapy  
- Treat for other identified deficiencies  
- If anemia (Hgb < 10 gm/dL) not corrected with iron supplementation, consider treatment with Erythropoiesis stimulating agents (ESAs)  
- Initiation of ESA therapy should be individualized based on<sup>(6)</sup>  
  - Rate of fall of Hgb concentration  
  - Prior response to iron therapy | **At least annually**  
- Monitor blood pressure with each dose of ESAs  
- Monitor Hgb at least weekly until stable, then at least monthly if on ESAs  
- During the maintenance phase of ES therapy, measure Hgb at least every 3 months<sup>(6)</sup>  
- FDA recommendation is to individualize dosing and use the lowest dose of ESA sufficient to reduce the need for red blood cell transfusions. Adjust dosing as appropriate |
<table>
<thead>
<tr>
<th>Renal Bone Disease <em>(7,24)</em></th>
<th>Goals (Adult) iPTH:</th>
<th>Goals (Adult) Serum phosphorus <em>(PO₄)</em> <em>(7)</em></th>
<th>Goals (Adult) Monitor iPTH every:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Measure serum levels of calcium, phosphorus, and intact plasma parathyroid hormone (iPTH) in all adults with a GFR of &lt; 60 ml/min/1.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Check patients for signs/symptoms of hypocalcemia</td>
<td>• 35 - 70 pg/mL with eGFR 30 - 59 mL/min/1.73 m² (Stage 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 70 - 110 pg/mL with eGFR 15-29 mL/min/1.73m² (Stage 4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 150 - 300 pg/mL with eGFR of ≤ 15 mL/min/1.73 m²</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 2.7 - 4.6 mg/dL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Restrict dietary phosphorus <em>(PO₄)</em> (0.8 - 1 gm/day): <em>(7)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If serum PO₄ &gt; 4.6 mg/dL or iPTH above target range in Stages 3 and 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If serum PO₄ &gt;5.5 mg/dL in Stage 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If iPTH above target range for CKD Stage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Initiate drug therapy with phosphate binders if unable to maintain target iPTH or PO₄ levels with diet restrictions if PO₄ &gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monitor Calcium/Phosphorus every</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12 months for CKD Stage 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 3 months for Stage 4 and 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bone mineral density (BMD) should be measured by dual energy X-ray absorptiometry (DEXA) in patients with fractures and in those with</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Every month for Stage 5</td>
</tr>
<tr>
<td>Stage 5, hemodialysis, or peritoneal dialysis:</td>
<td>3.5 – 5.5 mg/dL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Serum 25-hydroxyvitamin D:**
- > 30 ng/mL

**Calcium:**
- For patients in Stages 3-5
  - Patients with corrected serum total calcium levels below the lower limit for the laboratory used (< 8.4 mg/dL [2.10 mmol/L]) should receive therapy to increase/normalize serum calcium levels if signs/symptoms of hypocalcemia present, or intact PTH is above target
  - Total elemental calcium intake (including both dietary calcium intake and calcium-based phosphate binders) should not exceed 2,000 mg/day

- Calcium-based phosphate binders may be used as the initial therapy [7]
- If PO₄ is > 4.6 mg/dL and serum vitamin D level is < 30 ng/dL and serum calcium level is < 9.5 mg/dL, initiate supplementation with vitamin D and increase phosphate binder dosage
- Treatment of hypocalcemia should include calcium salts such as calcium carbonate +/- oral vitamin D sterols
- If plasma intact PTH is above the target range for the stage of CKD, serum 25-hydroxyvitamin D should be measured at first encounter. If it is normal, repeat annually
- If the serum level of 25-hydroxyvitamin D is <30 ng/mL, supplementation with vitamin D2, (ergocalciferol) should be initiated

Following initiation of vitamin D therapy:
- The use of ergocalciferol

- Monitor serum PO₄: [7]
  - monthly while on restriction
- Total elemental calcium intake should not exceed 2,000 mg/day (therapy + diet)
- Serum level of corrected total calcium should be maintained within the “normal” range of the reference laboratory used
- In patients with CKD Stages 3-5, maintain serum calcium-phosphorus product at <55 mg²/dL². This is best achieved by controlling serum phosphorus levels within the target range
- Treatment with an active vitamin D sterol should be undertaken only in patients with serum levels of corrected total calcium <9.5 mg/dL (2.37 mmol/L) and serum phosphorus <4.6 mg/dL (1.49 mmol/L)
- Vitamin D sterols should not be prescribed for patients with rapidly worsening kidney function or those who are noncompliant with medications or follow-up
- During therapy with vitamin D sterols, serum levels of calcium and phosphorus should be monitored at least every month

**Known risk factors for osteoporosis**
Serum Calcium x Phosphorus product < 55 mg²/dL²

- The serum levels of corrected total calcium and phosphorus should be measured at least every 3 months.
- If the serum level of corrected total calcium exceeds 10.2 mg/dL, discontinue ergocalciferol therapy and all forms of vitamin D therapy.
- If the serum phosphorus exceeds 4.6 mg/dL, add or increase the dose of phosphate binder.
- If hyperphosphatemia persists, discontinue vitamin D therapy.
- In patients with CKD Stages 3 and 4, therapy with an active oral vitamin D sterol (calcitriol, alfacalcidol, or doxercalciferol) is indicated when serum levels of 25(OH)-vitamin D are >30 ng/mL (75 nmol/L) and plasma levels of intact PTH are above the target range for the CKD stage.
- In CKD patients (Stages 3 after initiation of therapy for the first 3 months, then every 3 months thereafter. Plasma PTH levels should be measured at least every 3 months for 6 months, and every 3 months thereafter.
- Dosage adjustments for patients receiving active vitamin D sterol therapy should be made as follows:
  - If plasma levels of intact PTH fall below the target range for the CKD stage, hold active vitamin D sterol therapy until plasma levels of intact PTH rise to above the target range, then resume treatment with the dose of active vitamin D sterol reduced by half. If the lowest daily dose of the active vitamin D sterol is being used, reduce to alternate-day dosing.
  - If serum levels of corrected total calcium exceed 9.5 mg/dL (2.37 mmol/L), hold active vitamin D sterol therapy until serum calcium returns to <9.5 mg/dL (2.37 mmol/L), then resume treatment at half the previous dose. If the lowest daily dose of the active vitamin D sterol is being used, reduce to alternate-day dosing.
  - If serum levels of phosphorus rise to >4.6 mg/dL (1.49 mmol/L), hold...
and 4) who have plasma levels of intact PTH >70 pg/mL (Stage 3) or >110 pg/mL (Stage 4) on more than 2 consecutive measurements, dietary phosphate intake should be restricted. If this is ineffective in lowering plasma PTH levels, calcitriol or one of its analogs (alfacalcidol or doxercalciferol) should be given to prevent or ameliorate bone disease(7).

- In CKD patients (Stage 5) who have elevated plasma levels of intact PTH (>300 pg/mL), calcitriol or one of its analogs (doxercalciferol, alfacalcidol, or paricalcitol) should be used to reverse the bone features of PTH overactivity (i.e., high-turnover bone disease) and to treat defective mineralization(7).

- Osteomalacia due to vitamin D2 or D3 deficiency or phosphate depletion, though uncommon, should be treated with vitamin D2 or D3 supplementation and/or active vitamin D therapy, initiate or increase dose of phosphate binder until the levels of serum phosphorus fall to <4.6 mg/dL (1.49 mmol/L), then resume the prior dose of active vitamin D sterol.

- If serum vitamin D level is normal, repeat testing annually.

- Monitor serum calcium and phosphorus levels every month on initiation of vitamin D therapy and then every 3 months. If calcium level is ≥ 10.2 mg/dL, discontinue vitamin D therapy or calcium binder and re-check.

- Once repletion of vitamin D is complete, switch from vitamin D to multi-vitamin preparation that contains vitamin D with annual reassessment of serum levels of 25-hydroxyvitamin D, and the continued assessment of corrected total calcium and phosphorus every 3 months.

- Parathyroidectomy should be recommended in patients with severe hyperparathyroidism (persistent serum levels of intact PTH >800 pg/mL), associated with hypercalcemia and/or hyperphosphatemia that are refractory to medical therapy.
<table>
<thead>
<tr>
<th>phosphate administration, respectively</th>
</tr>
</thead>
<tbody>
<tr>
<td>• If osteomalacia due to vitamin D deficiency fails to respond to ergocalciferol or cholecalciferol, particularly in patients with kidney failure (Stage 5), treatment with an active vitamin D sterol may be given</td>
</tr>
<tr>
<td>• Doses of phosphate supplementation should be adjusted upwards until normal serum levels of phosphorus is achieved</td>
</tr>
<tr>
<td>Effective surgical therapy of severe hyperparathyroidism can be accomplished by subtotal parathyroidectomy or total parathyroidectomy with parathyroid tissue autotransplantation</td>
</tr>
<tr>
<td>In patients who undergo parathyroidectomy the following should be done:</td>
</tr>
<tr>
<td>➢ The blood level of ionized calcium should be measured every 4 to 6 hours for the first 48 to 72 hours after surgery, and then twice daily until stable</td>
</tr>
<tr>
<td>➢ If the blood levels of ionized or corrected total calcium fall below normal (&lt;0.9 mmol/L or &lt;3.6 mg/dL corresponding to corrected total calcium of 7.2 mg/dL), a calcium gluconate infusion should be initiated at a rate of 1 to 2 mg elemental calcium per kilogram body weight per hour and adjusted to maintain an ionized calcium in the normal range (1.15 to 1.36 mmol/L or 4.6 to 5.4 mg/dL)</td>
</tr>
<tr>
<td>➢ The calcium infusion should be gradually reduced when the level of ionized calcium...</td>
</tr>
</tbody>
</table>
attains the normal range and remains stable

> When oral intake is possible, the patient should receive calcium carbonate 1 to 2 g 3 times a day, as well as calcitriol of up to 2 ug/day, and these therapies should be adjusted as necessary to maintain the level of ionized calcium in the normal range

> If the patient was receiving phosphate binders prior to surgery, this therapy may need to be discontinued or reduced as dictated by the levels of serum phosphorus

> Imaging of parathyroid glands with 99Tc-Sestamibi scan, ultrasound, CT scan, or MRI should be done prior to re-exploration parathyroid surgery

### Selected Preventive Health Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen for illicit drug use</td>
<td>Obtain history of current and past use of illicit drugs</td>
</tr>
<tr>
<td>Document patient's use patterns</td>
<td>Recommend appropriate lifestyle changes and/or referral to appropriate substance abuse program</td>
</tr>
<tr>
<td>Re-evaluation each visit</td>
<td></td>
</tr>
</tbody>
</table>

(1,12,13,14,17,25)
<table>
<thead>
<tr>
<th>Vaccination Type</th>
<th>Requirements</th>
<th>Frequency</th>
</tr>
</thead>
</table>
| Pneumococcal Vaccination<sup>17</sup> | - Document if patient has received a pneumococcal vaccination  
- Document if adverse event occurs | As indicated |
| Influenza vaccination | - Document if patient has received an influenza vaccination  
- Document if adverse event occurs | Yearly |
| | - Persons with immunocompromising conditions (including chronic renal failure and nephrotic syndrome) are recommended to receive PCV13 and PPSV23 vaccines. A one-time revaccination 5 years after the first dose of PPSV23 is recommended for people age 19-64 with chronic renal failure or nephrotic syndrome or immunocompromising conditions | |
- [http://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html](http://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html) | |
<p>| | - Administer vaccination to all patients age 6 months and older beginning each September | |</p>
<table>
<thead>
<tr>
<th><strong>Aspirin therapy</strong></th>
<th><strong>Document aspirin therapy on appropriate patients, and reasons for no aspirin on those who are not on therapy</strong></th>
<th><strong>Aspirin is indicated for secondary prevention but not for primary prevention (1)</strong></th>
<th><strong>Yearly</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight management</strong></td>
<td><strong>Calculate Body Mass Index (BMI) and measure waist:</strong>&lt;br&gt;  - BMI Target: 18.5-24.9 kg/m²&lt;br&gt;  - Waist Target: ≤35 inches for females, ≤40 inches for males (criteria varies for different ethnic groups)&lt;br&gt;  - Weight loss in the dialysis patient should be monitored closely by a physician and registered dietician</td>
<td><strong>Prescribe individualized weight management, diet, and physical activity programs</strong></td>
<td><strong>Monitor progress at each visit</strong></td>
</tr>
</tbody>
</table>

---

(1) Ref: *(source)*
<table>
<thead>
<tr>
<th>Physical Activity</th>
<th>Goal is 150 minutes per week of moderate intensity aerobic exercise&lt;sup&gt;25&lt;/sup&gt;</th>
<th>Recommend appropriate exercise/physical activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Low-level strengthening exercises may also be beneficial&lt;sup&gt;25&lt;/sup&gt;</td>
<td>• Exercise should be on non-consecutive days&lt;sup&gt;25&lt;/sup&gt;</td>
<td>• Monitor progress at each visit</td>
</tr>
<tr>
<td>• Document Hepatitis B (HB) vaccination in patients with end stage renal disease, including those receiving hemodialysis</td>
<td>• Adult patients receiving Hemodialysis should receive 1 dose of 40mcg/mL (Recombivax HB) administered on a 3-dose schedule at 0, 1, and 6 months or 2 doses of 20 mcg/mL (Engerix-B) administered simultaneously on a 4-dose schedule at 0,1,2, and 6 months&lt;sup&gt;17&lt;/sup&gt;</td>
<td>• As needed</td>
</tr>
<tr>
<td>• Serologic testing is recommended 1-2 months after administration of the last dose of the vaccine series to determine protective level of anti-HBs (≥ 10 mIU/mL)</td>
<td>• <a href="http://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html">http://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html</a></td>
<td></td>
</tr>
</tbody>
</table>

### Nutritional Evaluation

<table>
<thead>
<tr>
<th>Adults with eGFR &lt; 60 mL/min/1.73 m² should undergo assessment of dietary protein, energy intake, and nutritional status</th>
<th>Evaluation by registered dietician should include serum albumin, percent standard body weight (NHANES II) or subjective global</th>
<th>KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease suggests:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Monitor serum albumin as a marker for protein energy malnutrition</td>
<td>• Monitor nutritional status every 1-3 months if GFR &lt; 30 ml/min/1.73 m²</td>
<td></td>
</tr>
<tr>
<td><strong>Key dietary components to slow progression of CKD:</strong></td>
<td><strong>Protein intake in of 0.8 g/kg/day in adults with and without diabetes and who have GFR &lt;30 ml/min/1.73 m²</strong></td>
<td><strong>Monitor nutritional status every 6 - 12 months if GFR is &gt; 30 ml/min/1.73 m²</strong></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>➢ Controlling BP by reducing sodium intake</td>
<td>➢ Avoid high protein intake (&gt;1.3g/kg/day) in adults with CKD at risk of progression</td>
<td></td>
</tr>
<tr>
<td>➢ Reducing excessive protein intake, if excessive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➢ Managing diabetes (if present)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Tobacco Use (1,13, 26-31)

<table>
<thead>
<tr>
<th><strong>Smoking cessation</strong></th>
<th><strong>Tobacco use patterns</strong></th>
<th><strong>Think 5A’s</strong>(28)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Prior attempts to quit</td>
<td>➢ <strong>Ask</strong> about smoking</td>
</tr>
<tr>
<td></td>
<td>• Readiness assessment</td>
<td>➢ <strong>Advise</strong> to quit</td>
</tr>
<tr>
<td></td>
<td>• Combination therapy with counseling and medications is more effective than either component alone</td>
<td>➢ <strong>Assess</strong> willingness to quit</td>
</tr>
<tr>
<td></td>
<td>• Use of e-Cigarettes</td>
<td>➢ <strong>Assist</strong> user to quit (i.e. refer to smoking cessation program and consider pharmacotherapy</td>
</tr>
<tr>
<td></td>
<td>• Factors to consider when choosing a pharmacotherapy**(26)**</td>
<td>➢ <strong>Arrange</strong> follow-up</td>
</tr>
<tr>
<td></td>
<td>➢ Clinician familiarity with the medications and contraindications for selected patients</td>
<td></td>
</tr>
<tr>
<td></td>
<td>➢ Previous patient experience with a specific pharmacotherapy (positive or negative)</td>
<td>First line pharmacotherapy adjuvants**(26)**</td>
</tr>
<tr>
<td></td>
<td>➢ Patient characteristics (e.g., history of)</td>
<td>• Nicotine replacement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Sustained-release bupropion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Varenicline</td>
</tr>
</tbody>
</table>

Second-line pharmacotherapies**(26)**

- Clonidine and nortriptyline
- Consider using second-line pharmacotherapies for

### Call on quit-date or within 72 hours to boost self-efficacy

- Assess at each visit: smoking status, weight gain, nicotine withdrawal symptoms
| **Consider Specialty Referral**  
(1,14,16,22,24) | • **Nephrology** | • Refer to Nephrology if: \(^\text{(1)}\)  
- acute kidney injury or abrupt sustained fall in GFR  
- GFR <30 ml/min/1.73 m\(^2\)  
- a consistent finding of significant albuminuria (ACR >300 mg/g or AER >300 mg/24 hours, approximately equivalent to PCR >500 mg/g or PER >500 mg/24 hours) | • Quantitative renal function evaluation  
• Kidney disease education before eGFR <30 mL/min/1.73 m\(^2\)  
• Vein preservation strategies for possible future access placement  
• Timely referral for planning renal replacement therapy (RRT) in people with progressive CKD in whom the risk of kidney failure within 1 year is 10-20% or | • As needed |
| --- | --- | --- | --- | --- |

- patients who are unable to use first-line medications because of contraindications or for patients for whom first-line medications are not helpful. Monitor patients for known side effects of second-line agents.

- **e-Cigarettes**\(^{27}\)  
  - Not FDA approved or regulated  
  - Not enough information about safety or effectiveness for cessation  
  - One of the FDA-approved safe and effective cessation medications is recommended.
<table>
<thead>
<tr>
<th>Progression of CKD†</th>
<th>Higher ‡, as determined by validated risk prediction tool†(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary red cell casts, RBC &gt; 20 per high power field sustained and not readily explained</td>
<td>If this is a stable isolated finding, formal referral (i.e., formal consultation and ongoing care management) may not be necessary and advice from specialist services may be all that is required to facilitate best care for the patients. This will be health-care system dependent. The aim is to avoid late referral, defined here as referral to specialist services less than 1 year before start of RRT†(1)</td>
</tr>
<tr>
<td>CKD and hypertension refractory to treatment with 4 or more antihypertensive agents</td>
<td></td>
</tr>
<tr>
<td>Persistent abnormalities of serum potassium</td>
<td></td>
</tr>
<tr>
<td>Recurrent or extensive nephrolithiasis</td>
<td></td>
</tr>
<tr>
<td>Hereditary kidney disease</td>
<td></td>
</tr>
</tbody>
</table>

† CKD progression is defined based on one or more of the following:(1)
- Decline in GFR category (≥90 [G1], 60-89 [G2], 45-59 [G3a], 30-44 [G3b], 15-29 [G4], <15 [G5] ml/min/1.73 m2). A certain drop in eGFR is defined as a drop in GFR higher ‡, as determined by validated risk prediction tool†(1)
category accompanied by a 25% or greater drop in eGFR from baseline
- Rapid progression is defined as a sustained decline in eGFR of more than 5 ml/min/1.73 m²/year
- The confidence in assessing progression is increased with increasing number of serum creatinine measurements and duration of follow-up

| Preserving Vascular Access (10) | • Assess every vascular access site (if present) for evidence of infection, thrill/bruit | • Look, listen and feel the access. Observe for stenosis, poor maturation, infection or “steal” | • Immediately refer back to the surgeon or interventionalist for prompt evaluation and intervention if abnormalities are found | • Instruct individuals on physical limitations of the access arm, what to report about the site, what to instruct those unfamiliar with access ports (proper techniques, rotation of cannulation sites, etc) | • Vascular surveillance at each visit starting at 6 weeks after placement with the proper referral to the interventionalist if needed, may result in an increased duration and survival of the Arteriovenous Fistula (AVF) |
| Screening for Abnormal Glucose Metabolism \(^{(1,14,18,24)}\) | • All CKD patients:  
  ➢ Screen for diabetes with a fasting glucose every 1-3 years | • Impaired Fasting Glucose (IFG):  
  ➢ Fasting Plasma Glucose (FPG) 100 - 125 mg/dL | • If abnormal follow American Diabetes Association (ADA) guidelines | • If normal, repeat at least every 3 years\(^{14}\)  
  • Repeat annually for high-risk patients |
| --- | --- | --- | --- | --- |
| | | • Impaired Glucose Tolerance (IGT):  
  ➢ 2 hour oral glucose tolerance test\(^{(14)}\)(OGTT) 140-199 mg/dL | | |
| | | • Criteria for diabetes;\(^{(14)}\)  
  ➢ FPG ≥ 126 mg/dL, or  
  ➢ Symptoms of DM and a casual glucose ≥ 200 mg/dL, or  
  ➢ Two-hour Plasma Glucose (PG) ≥ 200 mg/dL during a 75 gm OGTT, or  
  ➢ Glycated hemoglobin (A1C) ≥ 6.5% using a method that is National Glycohemoglobin Standardization Program (NGSP) certified and standardized to the Diabetes Control and Complications Trial (DCCT) assay | | |
### Depression Screening \(^{(9)}\)
- Screen for the presence of risk factors for depression
- If screening is positive for depression, conduct an assessment for the diagnosis and severity of depression
- Validated depression screening tool such as Patient Health Questionnaire (PHQ) 2
- Validated depression assessment and severity determination tool, such as PHQ-9
- Mental health history/treatment
- Administer treatment and/or refer patients who meet criteria for depression to a behavioral health specialist
- Screening is suggested at subsequent visits
- Evaluate response to depression treatment with three follow-up contacts in 12 weeks and adjust medication as indicated and/or confer with appropriate treating mental health specialists

### Screen for Cardiovascular Disease (CVD) \(^{(1,13,24)}\)
- All patients with CKD should be considered at increased risk for CVD
- All adults with Stage 3 and 4 CKD
- Assess for signs/symptoms and risk for CVD
- Patients with CKD who present with chest pain should be investigated for underlying cardiac disease and other disorders according to the same local practice for people without CKD \(^{(1)}\)
- Subsequent treatment should be initiated similarly \(^{(1)}\)
- Stress test if symptomatic or at high risk \(^{(13)}\)
- Echocardiogram \(^{(13)}\)
  - At the initiation of dialysis
- Refer for appropriate intervention
End of Life Issues \(^{(15)}\)

<table>
<thead>
<tr>
<th></th>
<th>Set appointment specifically to discuss end of life issues</th>
<th>None</th>
<th>Discuss patient’s prognosis, end of life, palliative care, life supportive care, hospice, and advanced directive with patients while they are stable</th>
<th>Update end of life conversations yearly or more frequently as appropriate</th>
</tr>
</thead>
</table>

* GFR CALCULATOR AVAILABLE at http://www.kdigo.org/clinical_practice_guidelines/pdf/CKD/KDIGO
† Do not use live attenuated influenza virus vaccine

These guidelines are intended as an educational reference and not as a substitute for the clinical judgment of the treating physician concerning appropriate and necessary care for a specific patient. These guidelines are based on the clinical references listed at the end of the document. Note that a specific treatment or therapy listed may not be a covered benefit for all individuals. Please check the individual’s eligibility and benefits plan.
## REFERENCE LIST

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
<th>Author(s)</th>
<th>Publication Year</th>
<th>URL</th>
<th>Date Retrieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>Source</td>
<td>Retrieved Date</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td>Source</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. Naftilan, Allen J., Associate Professor of Medicine, Vanderbilt University Medical School; Clinical Director, The Heart Failure Program, The Vanderbilt Heart Institute, Nashville, Tennessee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
