



**What are the stages of chronic kidney disease?** Since chronic kidney disease encompasses a continuum of kidney disease, five stages have been defined, based on the glomerular filtration rate (GFR):

Stage	Description	GFR (ml/min/1.73m <sup>2</sup> )
1	Kidney damage (usually structural) with normal or increased GFR	> 90
2	Kidney damage with mildly decreased GFR	60 - 89
3	Moderately decreased GFR	30 - 59
4	Severely decreased GFR	15 - 29
5	Kidney failure (renal replacement therapy indicated)	<15

**How should the GFR be determined?** This question is being vigorously debated by nephrologists, but currently the National Kidney Foundation recommends that an equation derived from the Modification of Diet in Renal Disease Study (MDRD) be used. The patient's lab results will automatically report the MDRD-generated GFR if you have ordered a serum creatinine. This GFR is calculated using three demographic (race, gender, age) variables and the patient's serum creatinine.

**Is the MDRD GFR accurate?** Not always. It tends to **underestimate** true GFR, especially at GFRs closer to normal. In addition, it is not a reliable measurement in patients who are pregnant, have had a renal transplant, have had an amputation, or are at either extreme of body habitus. Unfortunately, its accuracy has also been questioned in the elderly patient. And, as with any measurement of renal function, it can only be relied upon if the creatinine is relatively stable.

**How should kidney function be measured if the patient's MDRD is thought to be inaccurate?** Newer and perhaps better calculations are being proposed. Until then, your alternative choice is a **24-hour urine for creatinine clearance**, especially for those patient groups in which you know that the MDRD calculation is inaccurate. A nuclear GLOFIL study can also be performed, but this study is limited by its cost and inconvenience to the patient.

**Is it really necessary to know the exact GFR of a patient?** No! There is essentially no difference in the management of a patient whose MDRD is say, 30 versus 40. What *is* important is to assess whether the renal function is stable or not.

**WHEN SHOULD THE PATIENT BE REFERRED TO A NEPHROLOGIST?** The National Kidney Foundation recommends that a renal consultation be considered for patients with an MDRD < 60.

#### **Comments:**

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- Check creatinine/MDRD on two separate occasions.
- Perform a 24-hour urine for creatinine clearance if you suspect the MDRD is inaccurate (see above).
- Rule out reversible causes of kidney failure, including volume depletion, congestive heart failure, nephrotoxins (especially NSAIDs), and urinary obstruction (especially in elderly males).
- Order a urinalysis, spot urine protein/creatinine (*not* microalbumin), and renal ultrasound – it will make the initial patient visit with the nephrologist more productive.
- Consider certain clinical conditions – age, comorbid conditions (for example, severe dementia), or patient wishes (advanced directive) – which may preclude referral.

Don't panic the patient! When possible, reassure the patient that his/her kidney function is stable. *Remember that the majority of patients with chronic kidney disease do not progress to kidney failure.*

After an initial evaluation is performed by a nephrologist, attention is next focused on treatment which helps maintain renal function. An equally important goal is to optimize cardiovascular health, since most patients with CKD will die of atherosclerotic disease before they ever reach the need for dialysis or renal transplant. A nephrologist and primary-care physician working together help make these therapeutic goals a reality.

## #1. HYPERTENSION

Controlling high blood pressure has been **proven** to be the most important treatment for slowing kidney damage.

### Target

- <130/80 if proteinuria < 1 g/24h
- <125/75 if proteinuria > 1 g/24h
- Avoid systolic < 110

### ACEI/ARB

These medicines have been **proven** to slow kidney damage – so they should be considered first-line antihypertensive agents in patients with CKD.

### Considerations Before Starting

- Serum K<sup>+</sup> should be <5.0 mEq/l
- Patient should not be volume deplete
- Patient's other meds should be evaluated; caution if patient on K<sup>+</sup>sparing diuretics or NSAIDs

### Monitoring

- Check chemistry profile in 1 week and 4 weeks after initiation
- Hold medicine if creatinine rises > 30%
- Hold medicine if K<sup>+</sup> > 5.5 mEq/l

### DIURETIC

These medicines are essential for blood pressure control in a patient with CKD, even when no overt edema is seen.

### Considerations Before Starting

- Thiazide diuretics are usually ineffective when serum creatinine > 1.8 g/dl
- Loop diuretics usually need BID dosing except for torsemide.

### Monitoring

- Check chemistry profile 1 week and 4 weeks after initiation.

**\*\* Do not hesitate to call nephrologist concerning questions about antihypertensive therapy.**

## #2. CHOLESTEROL MANAGEMENT

Triglyceride increases in CKD, and the presence of nephrotic range proteinuria increases LDL. Hyperlipidemia accelerates the progression of CKD; control of cholesterol has been shown to **almost certainly** slow kidney damage.

### Targets

- Total Cholesterol <180 mg/dl
- HDL >40 mg/dl
- LDL <100 mg/dl
- Triglycerides <150 mg/dl

### Treatment

**\* Usually, the nephrologist will defer the management of cholesterol to the primary-care physician.**

## #3. ANEMIA MANAGEMENT

Anemia is frequently present in CKD when GFR is <60ml/min. While correction of anemia will most certainly have cardiac benefits, it is **not yet proven** that administration of erythropoietin will slow progression of kidney damage.

### Targets

- Hct >30%
- Serum iron >100
- TSAT >20%
- Ferritin 100 - 500

### Treatment

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- Rule out “other” causes of anemia as suggested by indices
- Rule out gastrointestinal bleeding if iron deficiency is present
- Elemental iron 200 mg/day
- Tsat <20% and ferritin <500; essential for patients receiving erythropoietin
- Ingest on an empty stomach
- May add ascorbic acid 250-500 mg with each iron tablet to increase absorption
- Caution with other drugs/interference
- Erythropoietin when Hct <30%, as per nephrologist

### Monitoring

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- Not receiving erythropoietin or iron: CBC and iron studies every 3-6 months
  - Receiving iron: CBC and iron studies in 1 month, and then at least every 3 months
  - Receiving erythropoietin: CBC and iron studies at least monthly
- \*\* The nephrologist will usually prescribe oral iron and erythropoietin, as well as determine the need for parenteral iron in CKD patients. The diagnosis and treatment of other anemias are deferred to the primary-care physician.**

## #4. RENAL OSTEODYSTROPHY

*Metabolic bone disease is common in CKD, but it is **not yet proven** in humans that treatment of metabolic acidosis, vitamin D deficiency, hyperparathyroidism, or hyperphosphatemia will slow progression of kidney disease. Delaying treatment, however, can result in serious bone damage. Studies are also suggestive of extraskeletal benefits with vitamin D supplementation, but complicating hypercalcemia poses a risk in CKD patients.*

### Targets

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- HCO<sub>3</sub> 22-26 mEq/l
- Serum Ca 8.5-10 g/dl
- Serum Phos 2.5-4.5 g/dl
- PTH <70 stage III CKD  
<110 stage IV CKD
- Vit D (25-OH) >20 ng/ml

### Treatment

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- Bicarbonate therapy
  - 1 meq/kg daily
  - NaHCO<sub>3</sub> tabs 667 mg = 10 meq
  - Baking Soda 1 tsp = 40 meq
- Phosphate binders
  - Sevelamer carbonate 800-1600 mg TID with meals
- 25-OH Vitamin D therapy
  - Ergocalciferol 10,000 – 50,000 IU weekly x 8 weeks
  - Then over-the-counter vitamin D 800-1000 IU daily
  - Discontinue if 1,25-OH vitamin D begun
- 1,25-OH Vitamin D therapy
  - Calcitriol 0.5ucg daily (or pericalcetriol, doxercalciferol)
  - Avoid if serum Ca > 9.5g/dl or phos > 5.5 g/dl
  - Supplement 25-OH vit D if indicated, prior to 1,25-OH vitamin D

### Monitoring

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- Every 3 months
  - If treatment is begun, monthly labs until target level achieved, then every 3 months
  - Monitor calcium levels monthly if any Vitamin D is prescribed for at least 3 months
- \*\* The nephrologist will typically prescribe all of the above treatments, while deferring management of other bone disorders – such as osteoporosis – to the primary-care physician. Currently, bisphosphonates are not recommended in patients with GFR < 30 cc/min, although this is being reevaluated.*

## #5. NUTRITION

*Malnutrition progresses during the evolution of chronic kidney disease. On the other hand, protein restriction has been **proven** to slow – albeit modestly – the progression of kidney damage. A diet of high biological value protein must be maintained, with careful monitoring of the patient.*

### Treatment/Typical Restrictions

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- Protein <0.8g/kg/day
- Sodium <2000mg/day
- Potassium <2000mg/day if serum K >5mEq/l
- Phosphate <800mg/day if serum phos >4.5 g/dl

*\*\* The dietitian should be consulted to educate the patient.*

### Monitoring

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- Serum albumin at least every 6 months

## #6. PREPARING FOR RENAL REPLACEMENT THERAPY

*Some patients with CKD will progress to renal failure. The nephrologist will educate patients concerning their options, and timely preparation is essential.*

The primary-care physician is encouraged to avoid blood pressure monitoring and venous sticks in the patient's non-dominant arm.

*\*\* At GFR < 25 ml/min, the nephrologist will be involved in:*

- Pre-ESRD education
- Referral for renal transplant evaluation if desired
- Placement of AVF if hemodialysis replacement therapy chosen

## REFERENCES

National Kidney Foundation K/DOQI Clinical

Practice Guidelines for Chronic Kidney Disease, [www.kdoqi.org](http://www.kdoqi.org)

*Feel free to contact any of us at **Renal Specialists of Houston** with questions!*