



Chronic Kidney Disease

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Introduction

The purpose of this web-site is to aid primary care practitioners in the management of patients with chronic kidney disease (CKD) in the pre-dialysis period. Primary care practitioners are the focus of this site since the majority of CKD patients are under their care. The management of patients during this period requires a multidisciplinary approach between primary care physicians, nephrologists, endocrinologists, cardiologists, vascular surgeons, physician assistants, nurse practitioners, dieticians and social workers. The steps of this interdisciplinary approach are:

- Step 1** Slow the progression of chronic kidney disease to end-stage renal disease (ESRD)
- Step 2** Identify and treat co-morbid conditions (cardiovascular)
- Step 3** Identify and prevent complications of CKD (anemia, divalent ions, malnutrition)
- Step 4** Prepare the patient mentally and physically for renal replacement therapy

The approach is implemented in a step-wise fashion and will vary for the individual patient based on the severity of the impairment of the glomerular filtration rate (GFR). In the patient with a normal (60 - 90 ml/min/1.73 m²) or a mildly impaired GFR (\leq 60 ml/min/1.73 m²), the focus will be on delaying progression and treating co-morbid conditions (steps 1 and 2). For those with moderate impairment (GFR 30 - 60 ml/min/1.73 m²) one must begin to look for and treat potential complications of advancing CKD such as anemia and abnormalities in mineral metabolism (step 3). Whereas, for those with severe impairment (GFR 15-30 ml/min/1.73m²), preparations for renal replacement therapy should begin (step 4).

Approach

1. Establish the presence of CKD.
2. Estimate the GFR to categorize the patient.
3. Consult the steps relevant to the severity of disease.

Severity	GFR (ml/min/1.73m²)	Approach
Mild	60 - 90	Steps 1 , 2
Moderate	30-59	Steps 1 , 2 , 3
Severe	15-29	Steps 1 , 2 , 3 , 4

Frequently asked questions?

1. [What is chronic kidney disease \(CKD\)?](#)
2. [How big of a problem is it?](#)
3. [How do I estimate the severity of CKD: Why not use serum creatinine?](#)
4. [How do I estimate the rate of progression of chronic kidney disease?](#)

1. What is chronic kidney disease (CKD)?

The first question one might ask is why call it chronic kidney disease at all. A variety of terms have been used with pre-ESRD and chronic renal failure being the most common. There are several problems with these. Pre-ESRD gives the impression that dialysis is the inevitable outcome of all kidney diseases and that there are no effective therapies to retard its progression. It is the equivalent of referring to life as pre-death. The term renal failure also has a negative connotation and includes the term renal, which is not easily understood by patients and their families. For these reasons we have also avoided this term.

CKD results when a disease process damages the structural or functional integrity of the kidney. This is clinically detected using either physical exam (hypertension), laboratory (hematuria, proteinuria, microalbuminuria) or imaging studies (CT, MRI, IVP or renal ultrasound). Almost all patients with a GFR ≤ 60 ml/min/1.73m² have CKD. However, since GFR may decline normally with age (approximately 0.75 ml/min/1.73 m²/year after age 20), a GFR between 60 and 90 ml/min/1.73m² in the elderly may not be indicative of the presence of CKD. In order for patients to be classified as having CKD, there must be some objective evidence on either physical exam, laboratory or imaging studies of kidney damage.

2. How big a problem is CKD?

There are approximately 300,000 patients in this country with end-stage kidney disease either already on dialysis or in receipt of a kidney transplant and the number continues to grow each year. Based on estimates using data from the NHANES III study, there are another 350,000 people with severe CKD, 7.5 million with moderate CKD, and almost 22 million with mild CKD.

3. How does one estimate the severity of CKD: Why can't I use the serum creatinine?

Estimates of the glomerular filtration rate (GFR) based on the serum creatinine have a high degree of correlation with determinations of GFR based on inulin or iothalamate clearances. The later are more accurate but are cumbersome and costly. These equations also perform well when compared to collections of 24 hour urine which are difficult for patients to carry out and are often performed incorrectly. Two formulas commonly used are:

1. Cockcroft-Gault equation

$[[140 - \text{age}(\text{yr})] * \text{weight}(\text{kg})] / [72 * \text{serum Cr}(\text{mg/dL})]$ (multiply by 0.85 for women)

<http://www.intmed.mcw.edu/clincalc/creatinine.html>

2. MDRD equation 7

$170 * [\text{serum creatinine (mg/dL)}]^{-0.999} * [\text{age (years)}]^{-0.176} * [0.762 \text{ if pt is female}] * [1.180 \text{ if pt is black}] * [\text{BUN (mg/dL)}]^{-0.170} * [\text{albumin (g/dL)}]^{+0.318}$

<http://calc.med.edu/GFREEstimate.htm>

The serum creatinine alone is not an accurate measure of glomerular filtration rate. Creatinine unlike inulin is secreted by renal tubules and as renal function worsens the amount secreted increases. It is especially inaccurate when the serum creatinine is between 1-2 mg/dL. Normal ranges for serum creatinine are misleading because they do not take into account the age, sex, or weight of the patient. Consider the following two patients with identical serum creatinine of 1.2 mg/dL:

Patient 1- a 60 year old 50 kg woman

Patient 2- a 30 year old 90 kg man

The first patient has a GFR of 39 ml/min/1.73 m², which is markedly abnormal, while the second has a GFR of 115 ml/min/1.73 m², well within the normal range.

4. How to estimate the rate of progression of chronic kidney disease?

This is best done by plotting the reciprocal of serum creatinine over time. An excellent resource for doing this can be found on the Walter Reed Army Medical Center Section of Nephrology:

(<http://www.wramc.amedd.army.mil/departments/medicine/nephrology/tools/index.html>).

The program is available as an excel file that can be downloaded onto one's own personal computer. The program will predict a date when the GFR will reach target levels that are approved by the Center for Medicare and Medicaid Services for the initiation of Renal Replacement Therapy (RRT) (15 ml/min for diabetics and 10 ml/min for non-diabetics).

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Disclaimer

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