Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012

GFR categories (ml/min/1.73 m²) Description and range				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–300 mg/g 3–30 mg/mmol	>300 mg/g >30 mg/mmol
	G1	Normal or high	≥90			
	G2	Mildly decreased	60–89			
	G3a	Mildly to moderately decreased	45–59			
	G3b	Moderately to severely decreased	30–44			
	G4	Severely decreased	15–29			
	G5	Kidney failure	<15			

Green: Low risk (if no other markers of kidney disease, no CKD); Yellow: moderately increased risk; Orange: high risk; Red: very high risk.

FIGURE 26-1 Chronic kidney disease (CKD) nomenclature used by the Kidney Disease Improving Global Outcomes (KDIGO) consortium. CKD is defined as abnormalities of kidney structure or function, present for 3 months or longer, with implications for health. CKD is classified on the bases of cause, glomerular filtration rate (GFR), and albuminuria. (From KDIGO: 2012 clinical practice guideline for the evaluation and management of chronic kidney disease, Kid Intl Suppl 3:18, 2013. Available at http://www.kdigo.org/clinical_practice_guidelines/pdf/CKD/KDIGO_2012_CKD_GL.pdf. Accessed June 1, 2014.)

of the baseline level of serum creatinine is important; for example, change from 0.6 to 1.2 mg/dL is still within the normal range in an adult man but actually reflects an approximately 50% loss of GFR.

The relationship between GFR and serum creatinine is best interpreted at steady state and not when the GFR is changing rapidly. For example, bilateral nephrectomy in a patient with previously normal kidney function (as might occur in a patient with renal cell carcinoma) results in drop in GFR from 100 to 0 mL/min. However, serum creatinine would be expected to increase by only about 1 mg/dL/day, and a plateau may not be achieved before 1 week. This delay reflects the fact that the generation of creatinine is insufficient to saturate the volume of distribution of creatinine. A plateau will be reached more rapidly if the rate of creatinine generation is increased, the volume of distribution of creatinine is small, or residual renal function is substantial. Given these variables, it is important to be aware that serum creatinine may be a poor marker of GFR in non–steady-state conditions.

There also are several conditions in which serum creatinine may be falsely low in relation to the GFR. Because creatinine generation is dependent on muscle mass, low creatinine generation occurs in diseases associated with sarcopenia, such as motor neuron diseases (amyotrophic lateral sclerosis), wasting illnesses (advanced cancer, tuberculosis, cardiac cachexia), and even malnutrition. Visual examination of muscle mass (thighs, arms, temporal muscles) may therefore be important in the interpretation of serum creatinine concentrations. Other conditions associated with low creatinine generation include cirrhosis and advanced age. Creatinine generation is reduced in sepsis, and kidney function may be worse than is detectable by estimation of GFR through measurement of serum creatinine.

At very advanced levels of kidney disease (e.g., GFR <20 mL/min), creatinine is secreted and urea is absorbed by the tubule. Tubular secretion is balanced by tubular reabsorption, making measurements of urea clearance and creatinine clearance useful in estimating true GFR. An average of creatinine and urea clearance closely approximates true GFR in such situations.

At steady state—that is, when the patient is neither gaining or losing weight—the 24-hour urine urea nitrogen measurement can be used to estimate dietary protein intake. In addition to its excretion in urine, nitrogen is lost through the gut, through the skin, and, as non-urea nitrogen, through the kidney in proportion to body weight. It is estimated that 31 mg/kg/day of non-urea nitrogen is excreted in this fashion. Dietary protein intake can be calculated as 6.25 g protein per gram of total daily nitrogen excretion. Accordingly, the formula for dietary protein intake in grams per day is (urine urea nitrogen + 0.031 × body weight in kg) × 6.25.

Although urea by itself is less useful to assess kidney function, it can be helpful in conjunction with the serum creatinine measurement. Urea is reabsorbed by the tubule in sodium-avid states. The normal ratio of urea to creatinine is 10 : 1. In states of volume depletion such as diuretic use, diarrhea, sweat losses, or third spacing (e.g., ascites), the urea-to-creatinine ratio may be greater than 20 : 1. Sometimes, ratios greater than 20 : 1 are also seen in catabolic states (e.g., long-bone fracture, corticosteroid use, burns, sepsis), increased gut protein load (upper gastrointestinal bleeding, high-protein diet), or obstructive uropathy. In contrast,