Chronic Kidney Disease: Association of GFR Level with Complications

This is the fourth in the series of articles about chronic kidney disease.

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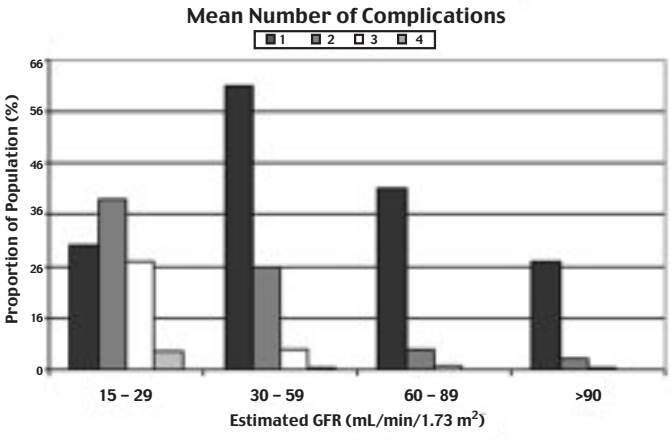
As has been described in previous articles in this series appearing in *The Provider*, identification, classification, and stratification of chronic kidney disease (CKD) are important aspect of patient care. The purpose of this article is to review the association of declining glomerular filtration rate (GFR) with complications of CKD in adults.

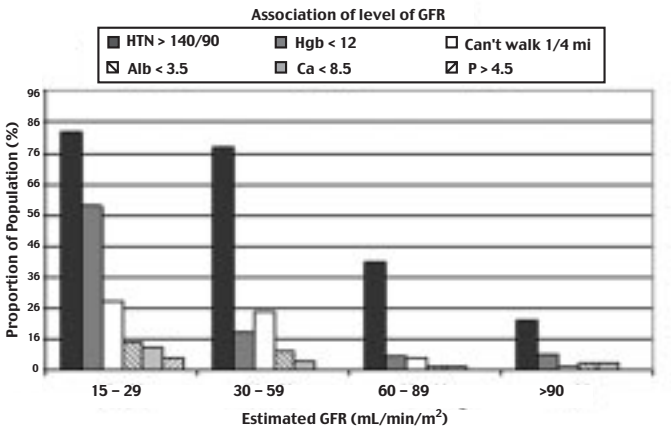
In general, as GFR declines, the number of complications increases. Figure 1 shows the estimated distribution of the number of complications by category of estimated GFR, from the National Health and Nutrition Examination Survey (NHANES III) data.

Figure 1. Comparison of number of complications by estimated level of GFR from NHANES III data (not adjusted for age)



Hypertension, anemia, malnutrition, bone disease and disorders of calcium and phosphorus metabolism, and decreased functioning (defined as an inability to walk 1/4 mile) are more prevalent as GFR declines. Figure 2 illustrates the association of these complications with decreased GFR. These complications are associated with adverse outcomes across the CKD spectrum.

Figure 2. Estimation of prevalence of selected complications by level of GFR from NHANES III data (not age adjusted)



The following provides a brief synopsis for each listed complication. Future articles will describe each in detail.

Hypertension

Hypertension is a cause and complication of CKD. If left untreated, hypertension can lead to more rapid decline in kidney function. All patients with CKD should have their blood pressure monitored routinely and treated aggressively.

Anemia

The anemia seen in CKD is due primarily to erythropoietin deficiency. Patients with a GFR less than 60 mL/min/1.73 m^2 (Stage 3) should be assessed for anemia. Hemoglobin is the preferred measure for assessing anemia since it is not affected greatly by shifts in plasma water. Hemoglobin levels lower than physiologic norms are considered anemic. The work-up for anemia includes a complete blood count, red cell indices, reticulocyte count, iron studies (TIBC, Fe, TSAT), ferritin, and evaluation for gastrointestinal bleeding.

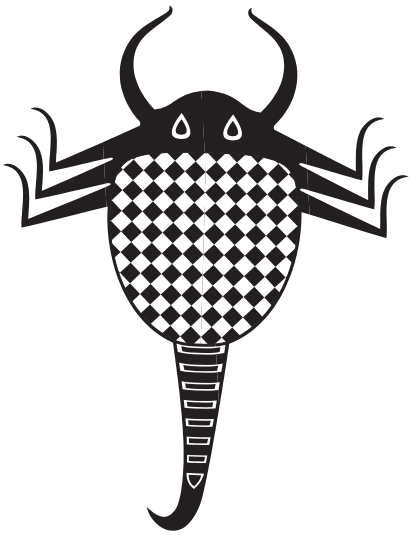
Malnutrition

Both inadequate protein and calorie intake are associated with the malnutrition seen in CKD. Appetite declines with decreased GFR. Metabolic acidosis, chronic inflammation, and altered taste negatively impact nutritional status. Patients with

a GFR less than 60 mL/min/1.73 m^2 should be referred to a registered dietitian for nutritional assessment. For those with GFR less than 20 mL/min/1.73 m^2 the nutritional assessment should include at least one value from each of the following: 1) serum albumin; 2) edema-free actual body weight, percent standard body weight (NHANES II), or subjective global assessment; and 3) normalized protein nitrogen appearance (nPNA) or dietary interviews and diaries.

Bone Disease and Disorders of Calcium and Phosphorus

Bone disease begins early in CKD and is not easily recognized — unless specifically assessed. Problems arise from both high turnover bone disease and low turnover bone disease. Patients with a GFR less than 60 mL/min/1.73 m^2 should be assessed for bone disease and associated disorders of calcium and phosphorus metabolism. Intact PTH, phosphorus, and ionized calcium are the most commonly used markers. Bone biopsies are not routinely recommended.



Functional Status

Functional status appears to decline in relation to declining GFR. Patients with a GFR less than 60 mL/min/1.73 m^2 should undergo regular assessment for functional impairment. Late referrals and inadequate pre-dialysis care; symptoms; effects of illness on physical, psychological, and social functioning; and satisfaction with care are all associated with decreased function. Low income and lower level of education are associated with greater functional impairments.

In summary, when GFR declines below 60 ml/min/m^2 (Stage 3 CKD), patients should be evaluated for anemia, malnutrition, bone disease, and declining functional status. Specific management of these complications will be discussed in future articles.