



PIC QUESTION OF THE WEEK: 12/14/09

Q: How does the Modification of Diet in Renal Disease Study equation apply to adjustment of drug dosing?

A: Since 1976, the Cockcroft-Gault (CG) equation (see below) has generally been considered the standard for drug dosage adjustment in patients with renal disease. However, there has been much discussion regarding use of the Modification of Diet in Renal Disease (MDRD) Study equation for drug dosing in patients with kidney impairment. The MDRD Study was conducted in 1999 and its authors subsequently derived an equation that was considered more accurate for estimating glomerular filtration rate (eGFR). Patients included in the study ranged from 18 to 70 years of age and suffered from chronic kidney disease. This method was discussed in a previous issue of the [PIC Question of the Week 9/08/08](#). An abbreviated version of the MDRD equation was later developed (see below) and is now recommended for estimating GFR. The MDRD equation has been used to categorize patients into the various stages of chronic kidney disease as defined by the National Kidney Foundation. One of the important characteristics of the formula is the lack of reliance on body weight as a major criterion for estimation of GFR. Although the abbreviated equation allows for better staging of patients with chronic kidney disease, its utility for dosing medications in those with renal dysfunction has come into question. A study comparing the MDRD and CG equations found that the MDRD *overestimated* GFR by 5.4 mL/min. Use of the MDRD equation occasionally resulted in patients receiving doses of some drugs that were higher than recommended. Currently, package labeling for renally excreted drugs includes dosing guidelines derived from pharmacokinetic studies using creatinine clearance (CrCl) values derived from the CG formula. While the MDRD equation enhances our ability to estimate the GFR, there is little data to support its routine use for drug dosing adjustments. It may, however, be used to screen patients to determine whether dosage changes are required. Clinicians should continue using the CG equation when providing dosing guidelines for patients with renal disease. The reader is encouraged to review the statement from the National Kidney Disease Education Program on *Chronic Kidney Disease and Drug Dosing* included the reference section below.

Cockcroft-Gault CrCl (mL/min)

$$= \frac{(140 - \text{age}) \times (\text{weight}^*)}{\text{SCr} \times 72}$$

* adjusted, ideal, OR total body weight has been used

Abbreviated MDRD GFR (mL/min/1.73 m²)

$$= 186 \times (\text{SCr})^{-1.154} \times (\text{age})^{-0.203}$$

x 0.742 (if female)
x 1.210 (if African American)

References

- Greenberg E, Saad N, Abraham T, et al. Drug dosage adjustment using renal estimation equations: a review of the literature. *Hosp Pharm* 2009;44:577-83, 603.
- Probst LA, Darko W, Smith A, et al. Pitfalls of the application of the modification of diet in renal disease equation to drug-dosing practices: a tertiary care teaching hospital experience. *Hosp Pharm* 2008;43:564-70.
- National Kidney Disease Education Program. Chronic kidney disease and drug dosing: information for providers (September, 2009). <http://www.nkdep.nih.gov/professionals/drug-dosing-information.htm>. Accessed November 30, 2009.

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