Difference Between Estimated Glomerulofiltration Rate by Modification of Diet in Renal Diseases and Cockcroft-Gault Formula in General Population

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Abstract

To characterize the differences between the estimated glomerular filtration rate (eGFR) by using Cockcroft-Gault (CG) and Modification of Diet in Renal Diseases (MDRD) formula. We retrospectively reviewed individuals in a hospital-based health-check program from 2003 to 2006. eGFR was calculated by MDRD formula (MDRD = 186 x [SCr]⁻¹.¹³ x [age]⁻⁰.²⁰₃ x [0.742 if female]) or CG ([[140-age] x weight (kg)]/ ([SCr x 72] x [0.85 if female]) and was adjusted for body surface area of 1.73 m²). A total of 7832 (3264 men and 4559 women) individuals with a mean age of 64±11.4 year-old were studied. Mean eGFR by MDRD and CG formula was 78.6±21.3 and 71.5±21.6 (p<0.0001) respectively. The mean MDRD-CG was 7.1±10.7 revealing that MDRD estimates were higher than CG estimates. The values of MDRD-CG correlated positively with age (r=0.067, p<0.0001) and negatively with body mass index (r= -0.549, p<0.0001) and serum creatinine (r= -0.069, p<0.0001). The MDRD-CG was significantly higher in male, individuals with hypertension, and those with diabetes (p<0.001, p=0.002, and p<0.001). In multiple linear regression analysis, age, gender, BMI, serum creatinine, hypertension and diabetes were independently associated with the differences between MDRD and CG formula. The difference between MDRD and CG formula is associated with age, gender, BMI, serum creatinine, hypertension, and diabetes. In clinical practice, physicians should be aware of these differences. (J Intern Med Taiwan 2009; 20: 148-154)

Key Words: BMI; Estimated glomerular filtration rate; Elderly; Cockcroft-Gault formula; Modification of diet in renal disease formula

Introduction

In general practice, a variety of mathematical formulas are provided for a rapid estimation of renal function which is important for general assessments of renal disease and the adjustments of drug dosages. These formulas contain common variables such as age, body weight, gender, serum creatinine, and albumin blood urea nitrogen levels. In February 2002, the Kidney Disease Outcome Quality Initiative (K/DOQI) of the National Kidney Foundation (NKF) published clinical practice guidelines for the estimation of glomerular filtration rate (GFR) using the Modification of Diet in Renal Disease (MDRD) study equation. This equation is estimated by the following formula:

\[
\text{MDRD} = 186 \times \left( \frac{\text{SCr}}{72} \right)^{-1.154} \times \left( \frac{\text{age}}{140} \right)^{-0.203} \times 0.742 \text{ (if female)}
\]

where SCr is serum creatinine in mg/dL or μmol/L. This formula is widely used in clinical practice and research to estimate GFR. However, there are concerns about the accuracy and applicability of the MDRD formula, particularly in certain populations, such as those with diabetes, hypertension, or older age. Therefore, the Cockcroft-Gault formula is an alternative method to estimate GFR:

\[
\text{CG} = \left( \frac{140-\text{age}}{\text{weight (kg)}} \right) \times \text{SCr} \times 72 \times 0.85 \text{ (if female)}
\]

where age is in years, weight is in kilograms, and SCr is in mg/dL or μmol/L. The Cockcroft-Gault formula is a simpler and more direct method for estimating GFR but may overestimate GFR in patients with diabetes or hypertension. In this study, we aimed to compare the differences between the estimated glomerular filtration rate by using Cockcroft-Gault (CG) and Modification of Diet in Renal Diseases (MDRD) formula in a hospital-based health-check program from 2003 to 2006. We retrospectively reviewed individuals with a mean age of 64±11.4 year-old and studied the differences between the two formulas. The results showed that MDRD estimates were higher than CG estimates, and the differences between the two formulas were positively correlated with age and negatively correlated with body mass index and serum creatinine. The differences were also significantly higher in male and those with diabetes and hypertension. In conclusion, the differences between MDRD and CG formula should be aware of these differences in clinical practice.