The Role of Serum Cystatin C in Estimation of Renal Function in Critically Ill Survivors

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Background: Estimation of renal function after critical illness is a challenging problem. Post critical illness, confounders such as malnutrition, severe muscle wasting, and volume overload can interfere serum creatinine level, the standard marker of renal function. Recently, serum cystatin C, a novel AKI biomarker not influenced by muscle mass and volume status, has been introduced. However, the role of cystatin C to estimate renal function in critically ill survivors is unknown.

Objective: We aimed to assess the accuracy of serum cystatin C as a marker of renal function in critically ill survivors by comparison with the 99mTc diethylenetriaminepentacetate (DTPA), the gold standard in estimation of glomerular filtration rate (eGFR).

Methods: Thirty-seven critically ill patients in intensive care units (ICU) with stable renal function and without hemodynamic instability were recruited. Their serum creatinine and cystatin C levels were measured. We calculated the estimated GFR by using three creatinine-based equations, i.e. 1) Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI Cr), 2) Caucasian Modification of Diet in Renal Disease (MDRD Cr), 3) MDRD Thai (MDRD Thai Cr), 3) two cystatin C-based equations (CKD-EPI CysC, MDRD Thai CysC), and 4) one equation combining Cystatin C and serum creatinine (CKD-EPI Cr-CysC). The 99mTc-DTPA plasma clearance was used as a reference for standard GFR. Spearman rank correlation and Bland-Altman plots were used to assess the correlation, bias, and accuracy between the eGFR from serum creatinine, serum cystatin C, and standard GFR.

Results: A total of 37 patients with mean age 60±16.4 years were included. The mean standard GFR by DTPA plasma clearance was 93.2±30.4 mL/min/1.73 m2. The mean eGFR by each formula varied from 63+27 to 135+77 mL/min/1.73 m2. A significant correlation was found between standard GFR and all estimated GFRs formula (R²=0.28 to 0.66, P<0.001 for all formula). The eGFR by CKD-EPI CysC had the highest correlation with standard GFR (R²=0.66), followed by CKD EPI SCr-CysC (R²=0.64), MDRD Thai CysC (R²=0.61), CKD EPI Cr (R²=0.31), MDRD Thai Cr (R²=0.33), and MDRD Cr (R²=0.28), respectively. CKD-EPI CysC also had the highest accuracy and the smallest bias in estimation of GFR, compared with standard GFR.

Conclusion: In critically ill survivors with stable renal function, serum cystatin C significantly outperforms serum creatinine in estimation of renal functions compared with standard GFR. Using CKD EPI cystatin C equation is suggested to calculate GFR in this specific setting.

Keywords: Critically ill survivors; GFR; Cystatin C; Intensive care units; 99mTc DTPA