Annals of Nuclear Medicine Vol. 19, No. 5, 399–405, 2005

Prediction of two-sample ^{99m}Tc-diethylene triamine pentaacetic acid plasma clearance from single-sample method

Li ZUO,* Ying-Chun MA,* Mei WANG,* Chun-Li ZHANG,** Rong-Fu WANG** and Hai-Yan WANG*

*Institute of Nephrology, Peking University First Hospital, Beijing, China
**Institute of Nuclear Medicine, Peking University First Hospital, Beijing, China

Objectives: To develop an equation to predict dual plasma sample method (DPSM) ^{99m}Tc-diethylene triamine pentaacetic acid (^{99m}Tc-DTPA) plasma clearance from single plasma sample method (SPSM), and to clarify the condition in which DPSM can be substituted by SPSM in measurement of glomerular filtration rate (GFR). ***Methods:*** Patients with chronic kidney disease (CKD) were selected. Watson modified Christensen and Groth equation was used to calculate ^{99m}Tc-DTPA plasma clearance by SPSM (sGFR). The equation recommended by the Nephrourology Committee of the Society of Nuclear Medicine was used to calculate ^{99m}Tc-DTPA plasma clearance by DPSM (tGFR) in each patient. The difference between sGFR and tGFR was expressed as percent of the average of these two methods, and tGFR was predicted from sGFR. Plasma creatinine was measured by the kinetic picrate method, and GFR estimated by abbreviated modification of diet in renal disease (MDRD) equation (aGFR) and Cockcroft-Gault equation (cGFR) were evaluated as criteria in selection of DPSM and SPSM. ***Results:*** Three hundred and sixty-nine patients with CKD were selected (208 male and 161 female). The average age and body weight were 51.4 ± 15.5 years and 67.2 ± 12.5 kg, respectively. The causes of CKD were glomerular disease, renal arterial stenosis, chronic tubulointerstitial disease, and other causes or causes unknown. The average tGFR was 62.9 ± 36.5 ml/min/1.73 m^2, ranging from 1–180 ml/min/1.73 m^2. sGFR was significantly correlated with tGFR ($r = 0.9194$, $p < 0.001$), but widely scattered when tGFR <30 ml/min/1.73 m^2; in contrast, then tGFR was ≥30 ml/min/1.73 m^2, the difference was contrast (−1.1%, 95% confidence interval −18.3%, 16.1%), and tGFR could be predicted from sGFR using the equation: predicted tGFR (ml/min/1.73 m^2) = $7.4244 + 0.7318 \times \text{sGFR} + 0.0022 \times \text{sGFR}^2$ ($n = 299$, $r^2 = 0.9428$, $p < 0.001$), and the difference decreased to 0.1%, 95% confidence interval (−15.8%, 16.0%). aGFR was better than cGFR in diagnosis of tGFR <30 ml/min/1.73 m^2, the diagnostic sensitivity of a cut off value of aGFR = 45 ml/min/1.73 m^2 was 91.8%, and recommended as a criterion in the selection of DPSM and SPSM. ***Conclusion:*** When GFR ≥30 ml/min/1.73 m^2, tGFR can be predicted from sGFR, which will simplify the reference GFR measurement in clinical trials. sGFR becomes widely scattered when tGFR is less than 30 ml/min/1.73 m^2. To obtain reliable reference GFR values, it is recommended that DPSM be used in clinical trials when aGFR is less than 45 ml/min/1.73 m^2.

Key words: glomerular filtration rate, ^{99m}Tc-DTPA, plasma clearance, single plasma sample method, dual plasma sample method