Error in Estimation of 24-hour Urine Protein Using Protein to Creatinine Ratio

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Background: Urine protein to creatinine ratio (UACR) is commonly used to estimate 24-hour urine protein (24hrUP). However, in our practice, we observe the discrepancy between both indices.

Objective: This study aimed to find an error in estimation of 24hrUP using UACR.

Methods: A prospective cohort study was conducted in Thammasat University Hospital from December 2016 to November 2017. Chronic kidney disease (CKD) patients were enrolled. All patients were simultaneously measured proteinuria by 24-hour urine collection and UACR using a standard method. Inadequate samples were excluded. We compared both indices using Pearson correlation. Bland and Altman plot was used to determine an agreement with pre-defined acceptable different range of ± 0.5. Furthermore, UACR was stratified into subgroups to find the most reliable range to estimate proteinuria using linear regression models.

Results: Sixty-six of total 147 CKD patients were included for analysis. The main reason for exclusion was inadequate 24-hour collection (44% of complete urine examination). Mean age (SD) was 60.4 (15.0) years and 63.6% were male. One-third had diabetes kidney disease. Mean estimated GFR (SD) was 58.7 (30.3) ml/min/1.73m2. We found a high correlation between 24-hour urine protein and UACR (r = 0.86; p < 0.001). Linear regression showed that the range of UACR with the highest agreement of 24hrUP was between 0-2, with equation: 24hr UP = 0.99 * UPCR – 0.01. Systematic uptrend of error was observed when UACR was more than 2 (Figure 1).

Conclusion: UACR is highly correlated with 24hrUP. We suggest the most reliable range of UACR used to estimate 24hrUP is ≤ 2. UACR of more than 2 overestimates 24hrUP.

Keywords: Measurement error, Proteinuria, Chronic kidney disease