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A Moratorium on the Spot Urine Calcium-to-Creatinine Ratio

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Letter-to-the-Editor

In your recent issue of *Urology*, Hong et al. present results of a study comparing 24-hour urine metabolite levels to corresponding spot urine metabolite/creatinine levels¹. In brief, investigators collected 30 paired spot urine and 24-hour urine specimens from outpatient stone formers. From these paired samples, they measured and compared calcium, phosphate, magnesium, urate, sodium, potassium, oxalate, citrate and the Differential Gibb's free energy values of calcium oxalate. Not surprisingly, investigators found a good correlation between spot and 24-hour measurements using Pearson's test, but poor agreement with a Bland Altman analysis.

The Hong article is in concordance with a study we previously conducted comparing 24-hour urine calcium (24HUC) levels to the spot urine calcium-to-creatinine ratio (SUCCR)². We recruited vitamin D insufficient post-menopausal women for a study evaluating the change in calcium absorption with vitamin D repletion³. We excluded women with a history of nephrolithiasis or chronic kidney disease. During the study, women completed two 24-hour stays in the University of Wisconsin Clinical and Translational Research Core. During these overnight stays, trained research nurses collected 28 fasting morning spot urine specimens and paired 24-hour urine collections from patients.

Like Hong et al., we compared the 24HUC and SUCCR measurements using Pearson's tests and Bland Altman analyses. Our correlation was poor ($r=0.57$) and our Bland Altman analysis revealed a significant difference between the two measurements, with the SUCCR underestimating the 24HUC by an average bias of 83 ± 14 mg. Additionally, we assessed sensitivity of the SUCCR to predict hypercalciuria using multiple definitions. These included upper limits of normal of 250 mg/24-hour and 4 kg/mg/24-hour⁴ and limits established from a reference population⁵. Compared to other definitions, the SUCCR demonstrated the highest

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sensitivity for hypercalciuria when using an upper limit of normal of 4 kg/mg/24-hour⁴. However, this sensitivity was only 33%.

In addition to comparing the 24HUC and SUCCR levels, we used regression models to predict 24HUC levels using the SUCCR and other variables. These variables included demographics, laboratory and nutritional measures. We constructed a formula using multivariate linear regression to predict 24HUC. In our sample, SUCCR, body mass index, parathyroid hormone, and 1,25(OH)₂D accounted for 75% of the variation in 24HUC. A formula incorporating these readily measurable variables demonstrated a diagnostic sensitivity of 100% and no significant bias using the Bland Altman test. We plan to validate the formula in an upcoming research study.

Hong's study differs from ours in patient population and sample collection methods. Hong et al. targeted stone formers and collected 24-hour urine in outpatients. We targeted healthy post-menopausal women and collected 24-hour urine specimens during inpatient research visits. Even with these differences, both studies highlight the need to stop using spot urine specimens to estimate 24-hour urine calcium values. Until a better method is developed and validated, providers should stop using a SUCCR or another spot urine metabolite/creatinine level in place of a 24-hour urine collection.

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