ORIGINAL ARTICLE

Diagnostic Accuracy of Spot Urine Uric Acid-to-creatinine Ratio in Identifying Renal Uric Acid Excretion Patterns in Hyperuricemic Patients: A Cross-sectional Study

Akshata Malagouda Patil[1*], Smita Sonoli[2], Praveen Jain[3], Manjunath Goroshi[4], Deepak Thiriveedi[5]

Received: 29 December 2025; *Accepted:* 25 February 2026

Abstract

Background: Hyperuricemia arises primarily from reduced renal uric acid clearance ("low secretors") or, less commonly, increased uric acid production. Differentiating these mechanisms is vital to guide urate-lowering therapy but conventionally requires 24-hour urine collection, which is cumbersome and prone to collection errors. This study evaluated the diagnostic accuracy of the spot urine uric acid-to-creatinine (UUA/Cr) ratio as a practical alternative to 24-hour urine testing for distinguishing low secretors from normal secretors in hyperuricemic patients.

Materials and methods: In this cross-sectional study conducted between April and September 2025 at KLE's Dr Prabhakar Kore Hospital and Medical Research Center, 39 adults with hyperuricemia (serum uric acid >7.0 mg/dL in males, >5.0 mg/dL in females) underwent both spot and 24-hour urine testing. UA and Cr concentrations were assessed using standard enzymatic assays. A 24-hour urine excretion threshold of ≥600 mg/day was used to define normal secretors, while values <600 mg/day indicated low secretors. Correlation between spot UUA/Cr ratio and 24-hour UA excretion was analyzed using Pearson's test, and receiver operating characteristic (ROC) analysis was done to identify optimal diagnostic cutoff.

Results: The spot UUA/Cr ratio correlated moderately with 24-hour urine UA excretion ($r = 0.429$, $p = 0.006$). Using the 24-hour UA excretion cutoff of more than or equal to 600 mg/day, the ROC curve exhibited an area under the curve (AUC) of 0.786, which indicates good discriminatory performance, and a spot UUA/Cr ratio cutoff of 1.59 showed 93.1% specificity and 50% sensitivity for the identification of normal excretors.

Conclusion: The spot UUA/Cr ratio provides a simple, noninvasive, and reliable method to distinguish low from normal uric acid secretors. A cutoff value of 1.59 offers high specificity for identifying normal renal excretion and could serve as a feasible substitute for cumbersome 24-hour urine testing in clinical practice.

Journal of The Association of Physicians of India (2026): 10.59556/japi.74.1543

Introduction

Hyperuricemia represents a major global health concern, with an estimated occurrence rate ranging from 13.85% to 21% across different populations.[1–3] This metabolic disorder serves as a precursor to gout, nephrolithiasis, and chronic kidney disease, affecting millions worldwide and imposing a substantial burden on healthcare systems.[4,5] The pathophysiology of hyperuricemia involves two primary mechanisms: overproduction of uric acid (accounting for approximately 10% of cases) and renal underexcretion (responsible for 90% of cases), with a small subset exhibiting combined characteristics.[6,7]

Accurate classification of hyperuricemia into these subtypes holds therapeutic implications, as treatment strategies differ fundamentally based on the underlying mechanism. Patients with renal underexcretion typically benefit from uricosuric agents such as probenecid or benzbromarone, which enhance renal excretion of uric acid.[8,9] Conversely, those with overproduction need enzymes such as xanthine oxidase and inhibitors like allopurinol or febuxostat to decrease the rate of uric acid synthesis.[10,11] However, inappropriate use of uricosuric agents in overproducers can precipitate nephrolithiasis due to excessive urinary uric acid concentration, making accurate phenotyping essential for safe and effective management.[12,13]

The gold standard for distinguishing between renal underexcretion and overproduction involves measurement of 24-hour urine UA excretion, with values below 600 mg/day on a regular diet (or below 300–400 mg/day on a purine-restricted diet) indicating underexcretion, while values exceeding 800–1000 mg/day suggest overproduction.[14–16] Despite its diagnostic utility, 24-hour urine collection has numerous practical challenges. These include patient inconvenience, incomplete sample collection, improper storage conditions, timing errors, and poor adherence to collection protocols, which collectively compromise specimen accuracy in more than 50% of cases. These complex logistics and low patient compliance have prompted investigation into simpler, more practical alternatives that can maintain diagnostic accuracy and are feasible in routine clinical practice.

The spot UUA/Cr is promising, as creatinine excretion remains relatively constant throughout the day (approximately 1 gram daily), potentially normalizing for variations in urine concentration.[17,18] Previous studies have explored this relationship with variable results. Some investigations in gout patients reported moderate correlations ($r = 0.398–0.429$) between spot UUA/Cr ratios and 24-hour urinary uric acid excretion,[19,20] while others demonstrated area under the curve (AUC) values ranging from 0.686 to 0.903 for predicting renal underexcretion.[21,22] Optimal cutoff value for spot UUA/Cr ratio that maximizes both sensitivity and specificity for identifying normal versus low renal excretors remains unclear, with proposed thresholds ranging from 0.34 to 1.59 across different studies.[23] But there is no Indian data for the same. Practical implementation guidelines are lacking regarding which cutoff values would be most appropriate for clinical decision-making, particularly when selecting patients suitable for uricosuric therapy. Our aim is to evaluate the diagnostic accuracy of spot UUA/Cr ratio as a predictor of 24-hour uric acid excretion patterns in Indian patients with hyperuricemia.

[1]Student; [2]Head, Department of Biochemistry; [3]Assistant Professor, Department of General Medicine; [4]Associate Professor; [5]Senior Resident, Department of Endocrinology, Jawaharlal Nehru Medical College, KLE Academy of Higher Education and Research, Belagavi, Karnataka, India; *Corresponding Author

How to cite this article: Patil AM, Sonoli S, Jain P, *et al.* Diagnostic Accuracy of Spot Urine Uric Acid-to-creatinine Ratio in Identifying Renal Uric Acid Excretion Patterns in Hyperuricemic Patients: A Cross-sectional Study. J Assoc Physicians India 2026;74(6):66–68.

Materials and Methods

Study Design and Study Setting

A cross-sectional investigation was performed between April and September 2025 at KLE's Dr. Prabhakar Kore Hospital and Medical Research Center, Belagavi. The objectives of the study were: (1) to determine the correlation between spot UUA/Cr ratio and 24-hour urinary uric acid excretion; (2) to establish optimal cutoff values using Receiver Operating Characteristic Curve (ROC) curve analysis for distinguishing normal excretors (≥600 mg/24 hours) from low excretors (<600 mg/24 hours); (3) to calculate the sensitivity and specificity of identified cutoff points; and (4) to assess whether spot urine testing could serve as a reliable alternative to 24-hour urine collection in clinical practice for phenotyping hyperuricemic patients prior to initiating uric acid-lowering therapy. The institutional ethics committee granted formal approval, and the study has been carried out according to the Helsinki Declaration's tenets.

Participant Selection

Male and female patients aged >18 years attending the endocrinology OPD and meeting the criteria for hyperuricemia (serum uric acid >5 mg/dL in females and >7 mg/dL in males) were included. Participants with a history of recent or ongoing use of diuretics, uricosuric medications, or SGLT2 inhibitors, as well as those unwilling to provide informed consent, were excluded. All subjects provided written and informed consent before enrollment. Baseline demographic and anthropometric data, such as age, sex, height, and weight, were systematically collected at study initiation.

Sample Collection and Laboratory Procedures

Blood samples were drawn to estimate serum uric acid and creatinine using standard enzymatic assays. For urine specimen collection, each participant was provided with detailed verbal and written instructions and supplied with two sterile containers: one (25 mL) for the collection of spot midstream urine, and another (2 L) for 24-hour urine collection. For the 24-hour protocol, subjects were instructed to discard the initial morning urine, collect all subsequent voided samples over the next 24 hours, including the first sample of the following morning, and maintain their usual diet throughout the collection period. All urine samples were promptly transported to the central laboratory and analyzed via fully automated ERBA EM 200 systems using validated enzymatic methods for quantification of UA and Cr.

The UUA/Cr ratio was derived by dividing the measured concentration of uric acid by that of creatinine in the spot urine sample.

Statistical Analysis

Microsoft Excel and IBM SPSS Statistics version 29.0 were utilized for statistical analysis and data processing. To ascertain whether continuous variables were normal, the Shapiro–Wilk test was employed. Variables with a normal distribution were shown using the mean ± standard deviation, while variables with skewed distributions were described using the median and interquartile range (IQR). Categorical variables were represented using percentages and frequencies. The relationship between quantitative variables was examined using Pearson's correlation coefficient. The diagnostic performance of the spot urine uric acid-to-creatinine ratio was evaluated by calculating the AUC, standard error, and 95% confidence intervals using receiver operating characteristic (ROC) curve analysis. The optimal cutoff was found using Youden's index, which maximizes [sensitivity + specificity–1].

Results

Baseline Characteristics and Study Population

A total of 145 adults aged 18–50 years were screened during the study period, of whom 39 participants (27% of the screened cohort) met the diagnostic criteria for hyperuricemia. The study cohort comprised 14 female participants (35.9%) and 25 male participants (64.1%), reflecting a male predominance consistent with known epidemiological patterns in hyperuricemic populations (Table 1).

Analysis of Correlation

To evaluate the connection between spot UUA/Cr ratio and 24-hour urinary uric acid excretion, Pearson's correlation analysis was performed. Moderately favorable and statistically significant correlation with Pearson's $r = 0.429$, $p = 0.006$, $n = 39$ was demonstrated between these variables. This finding indicates that as 24-hour urinary uric acid excretion increased, the spot UUA/Cr ratio showed a corresponding proportional increase, establishing a meaningful relationship between the two measurement approaches in the hyperuricemic population studied (Fig. 1).

Stratification by Renal Uric Acid Excretion Status

Participants were stratified based on 24-hour uric acid excretion patterns using the clinically established threshold of 600 mg/day. This classification yielded two groups: (1) normal secretors with 24-hour urinary uric acid excretion ≥600 mg/day ($n = 10$, 25.6% of the cohort), and (2) low secretors with 24-hour urinary excretion <600 mg/day ($n = 29$, 74.4% of the cohort). This distribution aligns with established epidemiological data demonstrating that renal underexcretion accounts for the majority of hyperuricemic cases.

Diagnostic Accuracy of Spot UUA/Cr Ratio

Receiver Operating Characteristic Curve (ROC) Evaluation

The analysis of the receiver operating curve was carried out to assess the diagnostic performance of the spot UUA/Cr ratio in predicting 24-hour urinary uric acid excretion patterns and differentiating normal secretors from low secretors. The resulting ROC curve demonstrated 0.786 (95% confidence interval) of AUC, indicating good discriminatory performance of the spot urine measurement

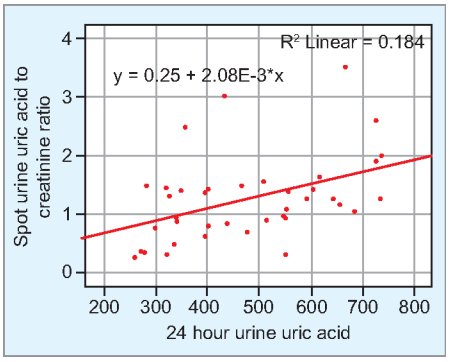

Fig. 1: Linear regression demonstrating positive correlation between spot UUA/Cr ratio and 24-hour uric acid in 39 hyperuricemia patients (Pearson's $r = 0.429$, $p = 0.006$; $R^2 = 0.184$)

Table 1: Baseline features of the 39 hyperuricemic participants ($n = 39$)

Variable	*Mean ± SD*
Age (years)	38.31 ± 10.51
Body mass index (kg/m^2)	24.02 ± 2.4
Serum uric acid (mg/dL)	9.08 ± 1.2
Serum creatinine (mg/dL)	1.02 ± 0.31
Spot urine uric acid (mg/L)	153.37 ± 65.19
Spot urine creatinine (mg/L)	135.78 ± 57.01
Spot urine uric acid to creatinine ratio	1.25 ± 0.73
24-hour urinary uric acid (mg/day)	478.1 ± 149.96

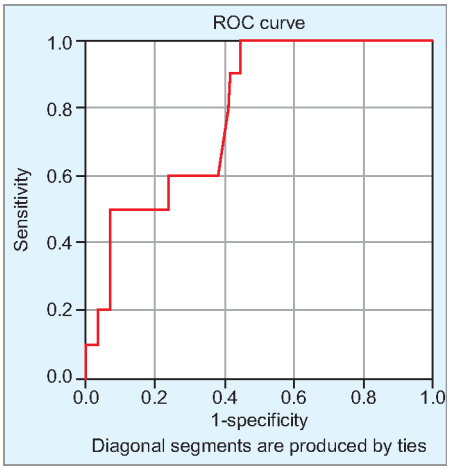

Fig. 2: Receiver operating characteristic curve for the "spot UUA/Cr ratio" in predicting normal "24-hour urinary uric acid excretion "(≥600 mg/day)

in distinguishing between the two excretion phenotypes (Fig. 2).

Optimal Cutoff for Identifying Normal Uric Acid Secretors

Analyzed the ROC curve, identified a clinically optimal threshold for spot urine UA/Cr ratio of 1.59 by Youden's index methodology (maximizing sensitivity + specificity − 1). At this cutoff, the spot UUA/Cr demonstrated 93.1% specificity and 50% sensitivity, providing excellent discrimination for confirming normal renal uric acid excretion (≥600 mg/day) in hyperuricemic patients. Conversely, a ratio <1.59 indicates probable renal underexcretion but does not exclude this possibility with certainty.

Discussion

In this cross-sectional analysis, we evaluated the diagnostic performance of the "spot urine uric acid-to-creatinine ratio" (UUA/Cr), identifying renal uric acid excretion patterns among individuals with hyperuricemia. The spot UUA/Cr ratio demonstrated a moderate positive correlation with "24-hour urinary UA excretion" ($r = 0.429$, $p = 0.006$) and showed good diagnostic accuracy (AUC 0.786). A cutoff value of 1.59 showed high specificity (93.1%) and moderate sensitivity (50%) for detecting normal renal excretion (≥600 mg/day), indicating that the test is most useful for confirming adequate uric acid clearance.

Results align with earlier reports by Sakane et al.[21] and Choi et al.[19], who documented AUC values between 0.68 and 0.80 for the same parameter in different populations, underscoring the reproducibility of the spot UUA/Cr ratio as a practical diagnostic measure. The predominance of renal underexcretion (74.4%) in our cohort reinforces the established understanding that impaired renal clearance is the primary driver of hyperuricemia in most patients. Accurate identification of these phenotypes helps in guiding the appropriate use of uricosuric agents versus xanthine oxidase inhibitors.

The simplicity and accessibility of spot urine testing offer a major advantage over 24-hour urine collection, which is often limited by patient nonadherence and collection errors. In clinical settings with high patient volumes or limited laboratory capacity, the spot UUA/Cr ratio could enable faster and more reliable phenotyping of hyperuricemic patients, facilitating individualized therapy and reducing the incidence of uric acid nephrolithiasis.

The study's strengths include its direct clinical applicability, use of standardized enzymatic assays, clearly defined inclusion criteria, and objective cutoff derivation through ROC analysis. A single-sample urine test is practical and easy to use in everyday settings, which makes the study's findings more relevant for real-world situations. However, limitations include a modest sample size and lack of dietary standardization, a single-center design, which may influence uric acid excretion.

Future multicenter studies with larger, ethnically diverse cohort studies are needed to validate the proposed cutoff and to assess its prognostic relevance for treatment response. Particular attention should be given to populations with comorbid conditions (renal and metabolic comorbidities) that may influence renal uric acid handling. Adoption of spot urine testing could improve patient adherence and diagnostic efficiency.

Conclusion

The spot UUA/Cr ratio offers a simple, reproducible, and noninvasive tool for assessing renal uric acid excretion in hyperuricemic patients. A threshold of 1.59 provides high specificity for identifying normal excretors, making it a clinically valuable alternative to the cumbersome 24-hour urine test. Implementation of this approach could improve patient adherence, reduce diagnostic errors, and guide safer, more targeted urate-lowering therapy. Larger multicenter studies should confirm these findings and refine reference values for broader clinical use.

Orcid

Akshata Malagouda Patil https://orcid.org/0009-0004-3472-2981
Smita Sonoli https://orcid.org/0000-0001-8430-6477

References

1. Zhu Y, Pandya BJ, Choi HK. Prevalence of gout and hyperuricemia in the US general population: the National Health and Nutrition Examination Survey 2007–2008. Arthritis Rheum 2011;63(10):3136–3141.
2. Chen-Xu M, Yokose C, Rai SK, et al. Contemporary prevalence of gout and hyperuricemia in the United States and decadal trends: the National Health and Nutrition Examination Survey, 2007–2016. Arthritis Rheumatol 2019;71(6):991–999.
3. Liu R, Han C, Wu D, et al. Prevalence of hyperuricemia and gout in mainland China from 2000 to 2014: a systematic review and meta-analysis. Biomed Res Int 2015;2015:762820.
4. Dalbeth N, Gosling AL, Gaffo A, et al. Gout. Lancet 2021;397(10287):1843–1855.
5. Terkeltaub R. Update on gout: new therapeutic strategies and options. Nat Rev Rheumatol 2010;6(1):30–38.
6. Yamamoto T. Definition and classification of hyperuricemia. Nihon Rinsho 2008;66(4):636–640.
7. Emmerson BT. The management of gout. N Engl J Med 1996;334(7):445–451.
8. Reginato AM, Mount DB, Yang I, et al. The genetics of hyperuricaemia and gout. Nat Rev Rheumatol 2012;8(10):610–621.
9. FitzGerald JD, Dalbeth N, Mikuls T, et al. 2020 American College of Rheumatology guideline for the management of gout. Arthritis Care Res (Hoboken) 2020;72(6):744–760.
10. Becker MA, Schumacher HR Jr, Wortmann RL, et al. Febuxostat compared with allopurinol in patients with hyperuricemia and gout. N Engl J Med 2005;353(23):2450–2461.
11. Borghi C, Perez-Ruiz F. Urate lowering therapies in the treatment of gout: a systematic review and meta-analysis. Eur Rev Med Pharmacol Sci 2016;20(5):983–992.
12. Sarawate CA, Brewer KK, Yang W, et al. Gout medication treatment patterns and adherence to standards of care from a managed care perspective. Mayo Clin Proc 2006;81(7):925–934.
13. Perez-Ruiz F, Calabozo M, Pijoan JI, et al. Effect of urate-lowering therapy on the velocity of size reduction of tophi in chronic gout. Arthritis Rheum 2002;47(4):356–360.
14. Faller J, Fox IH. Ethanol-induced hyperuricemia: evidence for increased urate production by activation of adenine nucleotide turnover. N Engl J Med 1982;307(26):1598–1602.
15. Feig DI, Kang DH, Johnson RJ. Uric acid and cardiovascular risk. N Engl J Med 2008;359(17):1811–1821.
16. Grassi D, Ferri L, Desideri G, et al. Chronic hyperuricemia, uric acid deposit and cardiovascular risk. Curr Pharm Des 2013;19(13):2432–2438.
17. Iheji CC, Asinobi IN, Ndu IK, et al. Assessment of the urinary uric acid-to-creatinine ratio as a diagnostic marker for perinatal asphyxia in a resource-poor setting: a case control study. BMC Pediatr 2025;25(1):599.
18. Mazzachi BC, Peake MJ, Ehrhardt V. Reference range and method comparison studies for enzymatic and Jaffé creatinine assays in plasma and serum and early morning urine. Clin Lab 2000;46(1–2):53–55.
19. Choi ST, Song JS, Kim SJ, et al. The utility of the random urine uric acid-to-creatinine ratio for patients with gout who need uricosuric agents: retrospective cross-sectional study. J Korean Med Sci 2020;35(13):e95.
20. Taniguchi Y, Hayashi T, Tsumura K, et al. Serum uric acid and the risk for hypertension and type 2 diabetes in Japanese men: the Osaka Health Survey. J Hypertens 2001;19(7):1209–1215.
21. Sakane N, Okuno A, Nomaguchi K, et al. Diagnostic accuracy of single spot urine for detecting renal uric acid underexcretion in men. J Clin Med Res 2020;12(7):443–447.
22. Perez-Ruiz F, Calabozo M, Herrero-Beites AM, et al. Improvement of renal function in patients with chronic gout after proper control of hyperuricemia and gouty bouts. Nephron 2000;86(3):287–291.
23. Yamamoto T, Moriwaki Y, Takahashi S, et al. A simple method of selecting gout patients for treatment with uricosuric agents, using spot urine and blood samples. J Rheumatol 2002;29(9):1937–1941.