

Stone size and serum creatinine levels in patients with unilateral nephrolithiasis

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Abstract

Background: Kidney stones can impair urinary flow and may be accompanied by changes in renal-function markers. Stone size is routinely considered during clinical assessment, while serum creatinine provides information about renal excretory function. Their association in unilateral nephrolithiasis warrants investigation.

Purpose: To examine the association between stone-size category and serum creatinine in patients with unilateral nephrolithiasis.

Method: This retrospective cross-sectional study analyzed 92 medical records, purposively selected from a reported population of 120 patients at Dr. H. Abdul Moeloek Regional General Hospital, Lampung Province. Records from 2025 were reviewed in February 2026. Stone size was categorized as <5 mm, 5–10 mm, or >10 mm. Serum creatinine was recorded in mg/dL, and the association between stone-size category and serum creatinine was assessed using Spearman's rank correlation.

Results: The sample included 51 men (55.4%) and 41 women (44.6%). Stones measured <5 mm in 52 patients (56.5%), 5–10 mm in 31 patients (33.7%), and >10 mm in 9 patients (9.8%). Mean serum creatinine was 1.61 mg/dL (range, 0.80–3.12). The stone-size category was significantly and positively associated with serum creatinine ($r_s = 0.732$, $p < 0.001$).

Conclusion: Higher stone-size categories were associated with higher serum creatinine in this hospital-based sample. The retrospective cross-sectional design and unadjusted analysis do not establish causality or an independent association.

Keywords: Nephrolithiasis; Serum Creatinine; Stone Size; Renal Function; Unilateral Kidney Stone.

INTRODUCTION

Nephrolithiasis involves the formation of calculi within the kidney and urinary tract through complex crystallization processes. Its occurrence is associated with environmental, dietary, metabolic, and genetic factors (Ma, Cheng, Jian, Wen, Xiang, Li, Wang, & Jin, 2024; Kachkoul, Touimi, El Mouhri, El Habbani, Mohim, & Lahrichi, 2023). Clinical manifestations may include pain, hematuria, nausea, vomiting, and impaired urinary flow. Stone size is one component of clinical assessment alongside location, number, composition, obstruction, infection, and the patient's condition (European Association of Urology [EAU], 2026; Geraghty, Davis, Tzelves, Lombardo, Yuan, Thomas, Petrik, Neisius, Türk, Gambaro, Skolarikos, & Somani, 2023).

The EAU (2026) stratifies stone size for clinical decision-making and recommends laboratory assessment, including serum creatinine. Contemporary guidance similarly emphasizes integrated assessment of stone characteristics, renal function, metabolic risk, and other clinical factors (Bhojani, Bjazevic, Wallace, Lee, Kaler, Dion, Cowan, Sultan, Chew, & Razvi, 2022; Carvalho, Matos, Santos, Barreto, Barreto, Rodrigues, Pietrobom, da Luz, Constancio, Gomes, & Heilberg, 2025). Stone size characterizes the calculi, whereas serum creatinine contributes to the evaluation of renal excretory function.

Serum creatinine is influenced by renal excretion as well as age, gender, muscle mass, dietary intake, physical activity, medications, hydration, and other clinical conditions (Ávila, Mora Sánchez, Bernal

Amador, & Paniagua, 2025). Its measurement is also method-dependent, and contemporary analytical work continues to refine enzymatic and mass-spectrometric approaches (Hokazono, Haraguchi, Higashinakao, Mominoki, Uchiumi, & Kayamori, 2025; Pineda-Cevallos, Funes Menéndez, González-Gago, Rodríguez-González, & García Alonso, 2024). An isolated elevated creatinine value, therefore, requires clinical context and does not by itself establish chronic kidney disease or prove that a stone caused the abnormality.

Previous Indonesian studies have described demographic, risk-factor, imaging, and clinical profiles of nephrolithiasis, including studies at Dr. H. Abdul Moeloek Regional General Hospital (Maulana, Purnanto, Triswanti, & Prasetya, 2023; Rahmawati, Purnanto, Triswanti, & Wahyudi, 2023; Gusna, Hasbie, Dalfian, & Sahara, 2025) and other Indonesian settings (Tombokan, Rondo, & Simanjuntak, 2024; Pradana, Anandasari, Margiani, & Suadiatmika, 2024). However, the association between stone-size category and serum creatinine in the local hospital population remains insufficiently characterized. This study, therefore, examined the association among patients with unilateral nephrolithiasis.

RESEARCH METHOD

This retrospective cross-sectional study used secondary medical record data from Dr. H. Abdul Moeloek Regional General Hospital in Lampung Province. The source population comprised 120 patients with nephrolithiasis, and 92 records were included through purposive sampling. Medical records from 2025 were reviewed in February 2026. The source manuscript did not specify the imaging modality used to determine stone size, the detailed record-selection criteria beyond purposive sampling, or the timing of serum creatinine measurement relative to imaging or treatment; these items are therefore reported as unavailable rather than inferred.

The independent variable was stone-size category, and the dependent variable was serum creatinine. Stone size was categorized as <5 mm, 5–10 mm, or >10 mm based on values documented in the medical record.

Serum creatinine was recorded in mg/dL and analyzed as a continuous variable. For descriptive reporting, the study also classified values relative to gender-specific study thresholds of ≤ 1.3 mg/dL in men and ≤ 1.1 mg/dL in women.

Stone-size categories were coded ordinally as 1 = <5 mm, 2 = 5–10 mm, and 3 = >10 mm. Spearman's rank correlation was used to assess the association between stone-size category and serum creatinine, with statistical significance set at $p < 0.05$.

RESEARCH RESULTS

Table 1. Patient characteristics (N = 92)

Variable	Results
Estimated age, years, mean $\pm$ SD	50.21 $\pm$ 14.49
Age(n%)	
18–25	3/3.3
26–35	13/14.1
36–45	23/25.0
46–55	16/17.4
56–65	19/20.7
>65	18/19.6

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Gender (n/%)

Male	51/55.4
Female	41/44.6

As presented in Table 1, most patients were male (51 patients, 55.4%). The 36–45-year age group was the most frequent (23 patients, 25.0%), whereas the 18–25-year age group was the least frequent (3 patients, 3.3%). The estimated mean age was 50.21 ± 14.49 years, calculated from grouped age categories. For this approximation, category midpoints were used and the open-ended >65-year category was represented by 70.5 years; this value is an estimate rather than an observed individual-level mean. The actual minimum and maximum ages were not available from the grouped data.

Table 2. Stone size and serum creatinine (N = 92)

Measure	Results
Stone-size category (n/%)	
<5 mm	52/56.5
5–10 mm	31/33.7
>10 mm	9/9.8
Total	92/100.0
Stone size, mean (range), mm	5.76 (1–11)
Serum creatinine category (n/%)	
Within threshold	20/21.7
Above threshold	72/78.3
Serum creatinine, mean (range), mg/dL	1.61 (0.80–3.12)

Table 2 demonstrates the distribution of stone size and serum creatinine. Stones measuring <5 mm were the most common (52 patients, 56.5%), whereas stones >10 mm were observed in 9 patients (9.8%). The mean stone size was 5.76 mm (range, 1–11 mm). Serum creatinine levels were above the study-defined threshold in 72 patients (78.3%), with a mean serum creatinine level of 1.61 mg/dL (range, 0.80–3.12 mg/dL).

Table 3. Association between stone-size category and serum creatinine

Variables	N	Spearman r_s	p value
Stone-size category and serum creatinine	92	0.732	< 0.001

Table 3 shows a strong positive correlation between stone-size category and serum creatinine ($r_s = 0.732$, $p < 0.001$). Higher stone-size categories were significantly associated with higher serum creatinine levels in the study sample.

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DISCUSSION

The principal finding was a strong positive association between stone-size category and serum creatinine. The result describes an overall relationship among the 92 analyzed records, but it does not demonstrate that stone size independently determines renal function or that increasing stone size causes the elevation in creatinine.

Obstruction provides a plausible clinical pathway linking stone disease with impaired renal function. The EAU (2026) recognizes obstruction and infection as important considerations in urolithiasis, while reviews similarly emphasize obstruction, infection, stone burden, and patient factors in the assessment and management of urolithiasis (Geraghty et al., 2023; Redfern & Mortimore, 2022). However, the present study did not test an obstructive mechanism or adjust for its severity, so the correlation should not be interpreted as evidence of a specific causal pathway.

Most patients had stones <5 mm, and only nine had stones >10 mm. The unequal category sizes limit interpretation of the largest-stone group. The study also combined all stones >10 mm into a single category, whereas the EAU (2026) uses more detailed size strata in its clinical algorithms. Consequently, these findings apply to the study's three-category classification and should not be generalized to more detailed size groups.

Serum creatinine was above the study-defined threshold in 78.3% of patients. This proportion describes a laboratory classification and should not be interpreted as the prevalence of chronic kidney disease. Creatinine varies with biological and clinical factors (Ávila et al., 2025). Longitudinal evidence has linked urolithiasis with a higher subsequent risk of chronic kidney disease, but such population-level associations do not establish that an elevated creatinine value in an individual patient was caused by a stone (Kim, Lee, Park, & Chang, 2024; Stepanova, 2025). Stone disease is also associated with broader systemic comorbidities that can complicate the interpretation of renal risk (Gambaro, Lombardi, Caletti, Ribichini, Ferraro, & Gambaro, 2022).

Male represented a modest majority of the sample, and the largest age group was 36–45 years. These findings describe the selected hospital records rather than population-level incidence or risk. Stone

composition and distribution can vary by age and gender (Siener, Rüdý, Herwig, Schmitz, Schaefer, Lossin, & Hesse, 2024), but the present study did not test whether these demographic characteristics modified the association between stone size and creatinine.

The analysis did not provide serum creatinine summaries separately for each stone-size category. The overall correlation, therefore, does not reflect the magnitude of differences in creatinine between individual categories. Category-specific means, medians, measures of dispersion, and adjusted estimates would provide a more informative description of the observed relationship.

The findings support considering stone characteristics alongside renal function measurements during patient assessment. Current reviews and guidelines emphasize individualized evaluation that integrates stone burden, symptoms, obstruction, infection, laboratory findings, and recurrence risk (Bhojani et al., 2022; Spradling, Ganesan, & Conti, 2022; Carvalho et al., 2025). Clinical interpretation of the present results remains limited by the retrospective design and absence of adjusted analysis. The study does not establish a stone-size cutoff for predicting renal impairment, determine treatment benefit, or support a causal conclusion.

LIMITATIONS

This single-hospital study relied on retrospectively reviewed medical records and was vulnerable to incomplete documentation and selection bias. Its cross-sectional design did not establish temporal order or causality. Reporting of the imaging method, handling of multiple stones, creatinine assay, and reference interval, timing of laboratory testing relative to imaging or treatment, and baseline kidney-function information were incomplete. Hydronephrosis, stone location and number, infection, comorbidities, medications, muscle mass, and hydration were not evaluated in an adjusted model. Only nine patients had stones >10 mm, and the broad stone-size categories further limited interpretation.

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CONCLUSION

Higher stone-size categories were associated with higher serum creatinine among 92 patients with unilateral nephrolithiasis (Spearman rho = 0.732; $p < 0.001$). This association was observed in a retrospectively selected hospital sample and does not establish causality or independence from other clinical factors.

SUGGESTION

Future studies should use larger samples, standardized imaging and laboratory measurements, and clearly documented timing of measurements relative to treatment. Assessment of estimated glomerular filtration rate, hydronephrosis, stone location and number, recurrent stones, diabetes, hypertension, body mass index, and other potential confounders would support a more informative analysis. Multivariable and longitudinal approaches could clarify whether stone size remains associated with renal-function measures after adjustment and over time.

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