

ORIGINAL ARTICLE

Association of KUB stones with UTI: A retrospective study

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| <p><b>Affiliations</b></p> <p>1. Associate Professor of Urology, Sialkot Medical College/ IITH, Sialkot</p> <p>2-6 4<sup>th</sup> Year MBBS Students of SMC</p> <p><b>Corresponding Author:</b><br/>Associate Professor of Urology, Sialkot Medical College/ IITH, Sialkot<br/>03008610686<br/>nadeemshafique@gmail.com</p> <p><b>Submission complete:</b> July, 2025<br/><b>Review began:</b> July, 2025<br/><b>Review ended:</b> Sep., 2025<br/><b>Acceptance:</b> Oct., 2025<br/><b>Published:</b> December, 2025</p> <p><b>Author contribution:</b><br/>NS: Designed the research Pattern and drafted the manuscript.<br/>STs. Data Collection</p> | <p><b>ABSTRACT</b></p> <p><b>Objectives:</b> The primary objective of this research was to ascertain the relationship between KUB stones and the frequency of UTIs in a cohort of affected patients including evaluation of demographic factors such as age, sex and determination of stone characteristics (size, side, and position).</p> <p><b>Methods:</b> A retrospective case-control study was conducted from March to June 2025 at Imran Idrees Teaching Hospital. The study utilized a purposive sampling technique to select patient medical records, comprising 35 cases with KUB stones and 35 controls without stones. Inclusion criteria required patients to be over 20 years of age with available CT KUB and urinalysis reports. Data was collected from hospital laboratory databases and analyzed using IBM SPSS Statistics version 27. Ethical approval was obtained from the Institutional review board of Sialkot Medical College.</p> <p><b>Results:</b> A statistically significant association was found between the presence of KUB stones and UTIs (<math>p&lt;0.001</math>), with patients in the stone group having a threefold higher odd of developing a UTI compared to the control group (odds ratio = 3.0, 95% CI: 1.47–6.13). Specifically, 60% of patients with stones had a UTI, in contrast to 20% of the control group. In a multivariable logistic regression model, both UTI status and sex emerged as significant independent predictors of the outcome.</p> <p><b>Conclusion:</b> The findings demonstrate a strong association between KUB stones and an increased risk of urinary tract infections.</p> <p><b>Keywords:</b> KUB stones, urinary tract infections (UTI), Urolithiasis, nephrolithiasis, bacterial colonization, retrospective study.</p> <p><b>Cite this Article as:</b> Shafique N. Mansoor Z., Khan MF., Naeem B., Razzaq L., Batool T.,; Association of KUB stones with UTI: A retrospective study. SIAL J Med. Sci. Dec-2025 V-4 (Issue-14):23-29</p> |
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Introduction

Urolithiasis, or the presence of stones in the kidney, ureter, or bladder (KUB stones), is a common health problem with serious consequences. Urinary tract infections (UTIs) are among the most common infectious disorders worldwide, impacting millions of people each year. The association between KUB stones and UTIs is understood to be bidirectional, with stones forming as a result of chronic infection or predisposing individuals to bacterial colonization. The current study was conducted to further define this relationship. Nephrolithiasis and the urolithiasis are

other names for renal stone disease. Nephrolithiasis is the term for renal stones that develop inside the kidneys. When these stones leave the renal pelvis and spread throughout the rest of the urine collecting system, which consists of the ureters, bladder, and urethra, a condition known as urolithiasis results.<sup>1</sup> Urolithiasis, referred to as KUB stones (kidney, ureter, and bladder stones), is a common health disorder. According to the available data, kidney stone disease affects roughly 16% of Pakistanis.<sup>2,3</sup> Urinary tract infections (UTIs) are infections that can

occur in the urethra (urethritis), bladder (cystitis), or kidneys (pyelonephritis) and are one of the world's most common infectious diseases, affecting 150 million people each year, with significant morbidity and high medical costs.<sup>4</sup>

The relationship between urinary stones and UTIs is well known and shows two different clinical pictures:

- 1) Stones that develop following UTIs (infection stones), which play a key role in stone pathogenesis, and
- 2) Stones complicated by UTIs (stones with infection), which are metabolic stones that passively trap bacteria from coexistent UTIs and may consist of calcium or non-calcium.<sup>5</sup>

KUB stones usually cause UTIs by creating conditions that are favorable for bacterial growth. Urinary tract obstruction is a risk factor for UTIs and the development of infection stones. When urine flow is impeded due to obstruction, the risk of infection increases as urine cannot pass smoothly.<sup>6</sup>

The surface topography of urinary stones is usually uneven and rich in organic residues from proteins, glycoproteins, and cellular debris, which promote bacteria adhesion. Additionally, urine macromolecules, particularly proteins released during infectious or inflammatory processes, can create a conditioning coating on the surface of stones, improving microbial adherence and encouraging colonization. This early phase of microbial interaction with the stone substrate sets the stage for biofilm.<sup>7</sup>

There are five primary types of commonly encountered urinary stones, i.e., calcium oxalate, calcium phosphate, magnesium ammonium phosphate, uric acid, and cystine.<sup>8</sup> Persistent urinary tract infections may result in the formation of magnesium ammonium phosphate stones, also known as struvite stones.<sup>9</sup> Only the hydrolysis of urea by urease results in the formation of struvite and carbonate-apatite stones. Only those bacteria that produce urease can form such

stones. Ureolysis by urease increases urinary levels of ammonia, bicarbonate, carbonate, and pH. Urinary supersaturation with regard to struvite and carbonate-apatite is caused by these chemical alterations, and crystal formation follows. These changes are associated with an increase in urinary proteins, which may also play a role in calculogenesis.<sup>8</sup> Precisely, stones and biofilms assist each other, i.e., stones trap bacteria and slow down urinary flow; on the other hand, biofilms assist stones in growing and persisting, each promoting the other.

KUB stones induce recurrent and complicated UTIs by promoting bacterial colonization and biofilm formation. The significance of studying this association lies in improving management strategies, reducing the recurrence rate, and preventing renal damage.

### Objectives

The primary objective of this research was to ascertain if kidney, ureter, and bladder (KUB) stones and the frequency of urinary tract infections (UTI) in afflicted patients were related.

The following were the secondary objectives:

- To evaluate how two demographic factors, i.e., age and sex, relate to the UTIs in patients with KUB stones.
- To assess how KUB stone predisposes patients to UTI.
- To ascertain the relationship between the development of UTI and the characteristics of the stone, such as its size, side, and position.
- To use multivariable logistic regression analysis to find independent predictors of UTI in patients with KUB stones by combining laboratory, clinical, stone-related, and demographic factors.

### Methodology

A retrospective case-control study was conducted from March 2025 up until June 2025 at Imran Idrees Teaching Hospital. In this

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study, existing medical records of patients diagnosed with KUB stones and UTIs were used.

Purposive sampling of hospital records, i.e., systematic selection of only record of those patients who were most relevant to the study objectives.

Keeping the inclusion criteria in consideration, data of n=50 patients was collected and recorded on an Excel sheet. Patients over 20 years old who were diagnosed with KUB stones were added. Patients with both CT KUB and urinalysis reports available in the hospital records.

Exclusion Criteria:

Insufficient or incomplete records. Age <20 years, Renal transplant recipients or patients on chronic immune-suppression.

Data regarding patients' CT KUB findings and corresponding urinalysis reports was retrieved from the hospital laboratory database. IBM SPSS Statistics version 27.

## Results

### Baseline Profile of Study Participants

In this study, descriptive analysis showed that the mean age of the participants was  $43.2 \pm 12.4$  years, with an age range of 18 to 75 years. Out of the total 70 patients, 35 (50%) were diagnosed with KUB stones, while 35 (50%) served as controls. Overall, 28 patients (40%) presented with urinary tract infection (UTI), whereas 42 patients (60%) had no evidence of UTI. The mean stone size among patients with KUB stones was  $10.4 \pm 4.8$  mm, ranging from 2.3 mm to 17.6 mm.

| Variable | Category/Range | N (%) or Mean $\pm$ SD |
|----------|----------------|------------------------|
| Sex      | Male (1)       | 42 (60.0%)             |
|          | Female (2)     | 28 (40.0%)             |
| Group    | Control (0)    | 35 (50.0%)             |
|          | Case (1)       | 35 (50.0%)             |
| UTI      | No (0)         | 42 (60.0%)             |
|          | Yes (1)        | 28 (40.0%)             |
| Diabetes | No (0)         | 62 (88.6%)             |

|                         |                    |            |
|-------------------------|--------------------|------------|
|                         | Yes (1)            | 8 (11.4%)  |
| Prior Urology Procedure | No (0)             | 66 (94.3%) |
|                         | Yes (1)            | 4 (5.7%)   |
| Stone Location          | Not applicable (0) | 35 (50.0%) |
|                         | Kidney (1)         | 14 (20.0%) |
|                         | Ureter (2)         | 11 (15.7%) |
|                         | Bladder (3)        | 10 (14.3%) |

**Table 1.** Baseline Categorical Characteristics of Study Participants (N = 70)

| Variable        | Range      | Mean $\pm$ SD   | N   |
|-----------------|------------|-----------------|-----|
| Age (years)     | 18–75      | $43.2 \pm 12.4$ | 70  |
| Stone size (mm) | 2.3 – 17.6 | $10.4 \pm 4.8$  | 35* |

\*Stone size was recorded only for patients in the stone group (n = 35).

**Table 2.** Continuous Variables (Age and Stone Size)

Among patients with stones, 60% (21/35) had UTIs, whereas only 20% (7/35) of the control group had UTIs. The chi-square test showed a statistically significant association between the presence of KUB stones and UTI ( $\chi^2 = 11.67$ ,  $df = 1$ ,  $p < 0.001$ ). The odds of developing UTI were three times higher in patients with stones compared to those without (OR = 3.0, 95% CI: 1.47–6.13).

| Group (Stone vs. Control) | UTI Present (n, %) | UTI Absent (n, %) | Total (n, %) |
|---------------------------|--------------------|-------------------|--------------|
| Stone group (n=35)        | 21 (60.0%)         | 14 (40.0%)        | 35 (50.0%)   |
| Control group (n=35)      | 7 (20.0%)          | 28 (80.0%)        | 35 (50.0%)   |
| Total (N=70)              | 28 (40.0%)         | 42 (60.0%)        | 70 (100.0%)  |

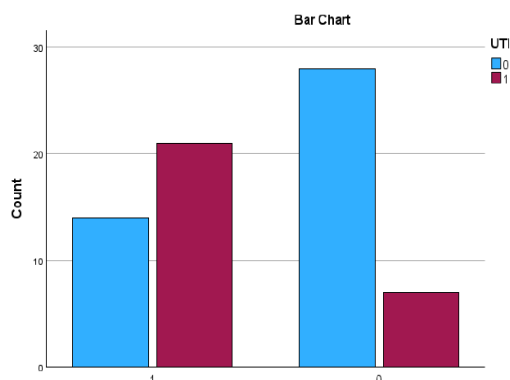
**Table 3**

### Chi-square Test Results:

- Pearson's Chi-square = 11.667,  $df = 1$ ,  $p < 0.001$  (significant)
- Fisher's Exact Test = 0.001 (significant)

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- Odds Ratio = 3.0 (95% CI: 1.467 – 6.137)



**Figure-1.**Distribution of Urinary Tract Infection (UTI) in Stone and Control Groups

#### Age Distribution across Study Groups

The mean age of patients in the stone group was  $44.8 \pm 10.7$  years (95% CI: 41.1–48.5), while in the control group it was  $41.6 \pm 13.8$  years (95% CI: 36.8–46.3). Overall, the study participants had a mean age of  $43.2 \pm 12.4$  years, with ages ranging from 18 to 75 years.

| Group             | N  | Mean Age (years) | SD (±) | Median | Min | Max | Range | 95% CI for Mean |
|-------------------|----|------------------|--------|--------|-----|-----|-------|-----------------|
| Stone group (1)   | 35 | 44.80            | 10.71  | 44.0   | 26  | 63  | 37    | 41.12 – 48.48   |
| Control group (0) | 35 | 41.57            | 13.77  | 40.0   | 18  | 75  | 57    | 36.84 – 46.30   |
| Total (N=70)      | 70 | 43.19            | 12.35  | –      | 18  | 75  | –     | –               |

**Table 4.**Descriptive Statistics of Age among Stone and Control Groups

#### Predictors of Outcome in Logistic Regression

The logistic regression model was statistically significant ( $\chi^2 (5) = 29.418$ ,  $p < 0.001$ ), explaining 34–46% of the variance and correctly classifying 74.3% of cases with good model fit (Hosmer–Lemeshow  $p = 0.683$ ). Among predictors, urinary tract infection (OR = 0.10, 95% CI: 0.03–0.38,  $p$

$< 0.001$ ) and sex (OR = 0.15, 95% CI: 0.04–0.56,  $p = 0.005$ ) were significant, both associated with reduced odds of the outcome. Age, diabetes, and prior urology procedures were not significant predictors. Thus, UTI status and sex emerged as independent determinants of outcome in this cohort.

| Predictor | OR (Exp (B)) | 95% CI for OR | p-value |
|-----------|--------------|---------------|---------|
| UTI (yes) | 0.10         | 0.03 – 0.38   | <.001   |
| Sex (1)   | 0.15         | 0.04 – 0.56   | 0.005   |

**Table 5.**Logistic Regression Predictors of KUB Stones

#### Discussion

This study analyzed the association between KUB (kidney, ureter, and bladder) stones and urinary tract infections (UTIs) in adult patients. Our findings illustrated a significant relationship, with 60% of patients in stone group presenting with UTIs compared to only 20% in the control group. The statistical analysis confirmed this association ( $\chi^2 = 11.67$ ,  $p < 0.001$ ), with the odds of developing UTI being three times higher among patients with KUB stones (OR = 3.0, 95% CI: 1.47–6.13). These results strongly support the hypothesis that urinary calculi predispose patients to recurrent infections by providing a nidus for bacterial colonization and impairing normal urinary flow.<sup>10,11</sup>

The demographic distribution of participants revealed a mean age of 43.2 years, with the stone group slightly older than controls (44.8 vs. 41.6 years). This aligns with the prior literature reporting that the risk of both stone formation and the recurrent UTIs tends to increase with age, particularly in middle-aged adults.<sup>12</sup> Gender distribution showed a male predominance (60%), consistent with the global epidemiological trends of urolithiasis<sup>13</sup>, though females are often reported to have a higher predisposition to UTIs due to shorter urethral length and hormonal factors.<sup>14</sup> This

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contrast emphasizes that while women are generally more susceptible to infections, the presence of stones significantly elevates UTI risk in both sexes.

With respect to stone location, kidney stones (20%) and ureteric stones (15.7%) were more common than bladder stones (14.3%). Previous studies have indicated that upper urinary tract stones are strongly associated with recurrent infections, particularly when causing obstruction.<sup>15</sup> Larger stones (mean size 10.4 mm) may contribute to persistent bacteriuria by obstructing urinary drainage, thereby explaining the higher infection rates in the stone group.<sup>16</sup>

These findings are clinically significant. They suggest that patients presenting KUB stones should be routinely evaluated for concurrent UTIs, even when asymptomatic, to prevent complications such as pyelonephritis, sepsis, or chronic kidney damage.<sup>17</sup> Furthermore, the demonstrated bidirectional relationship where stones predispose to infections and infections in turn promote stone recurrence has been described in earlier studies<sup>18</sup>, underscoring the importance of integrated management strategies. Prompt stone clearance combined with the appropriate antimicrobial therapy may reduce the burden of recurrent UTIs and long-term renal morbidity.<sup>19</sup>

#### **Conclusion:**

This study demonstrated a statistically significant association between KUB stones and urinary tract infections. Patients with stones had a threefold higher risk of developing UTIs compared to those without stones, highlighting the role of calculi as a strong predisposing factor.

#### **Limitations**

This study had certain limitations. First, the sample size was relatively small (70 patients), which may limit the generalizability of the findings to larger populations. Second, the study was conducted at a single center,

and thus the results may not fully represent the broader demographic or the geographic variations. Third, the cross-sectional design restricted the ability to establish causality between KUB stones and UTIs, as temporal relationships could not be determined. Additionally, potential confounders such as dietary factors, like hydration status, prior antibiotic use, and genetic predisposition were not assessed. Finally, the stone composition analysis was not performed, which could have provided further insight into the relationship between infection-related stones and UTI risk.

#### **Recommendation**

This study highlights the role of urinary calculi as a powerful predisposing factor for infection. The results underscore the critical need for routine UTI screening in patients with urinary stones, even in the absence of symptoms, to enable integrated management that combines stone clearance with appropriate antimicrobial therapy.

The findings emphasize the need for routine UTI screening in patients with the urinary stones, even in the absence of symptoms, to prevent complications. Integrated management, focusing on both stone clearance and infection control, is essential for reducing recurrence and protecting long-term renal health.

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**Conflict of Interest:** None

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