

Frequency and anatomical distribution of urinary tract stones in patients presenting to institute of kidney diseases (IKD) Peshawar

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ABSTRACT

Background: Urinary tract stones (UTS) is a prevalent urological issue and an important source of morbidity across the globe. Dietary fluctuations, sedentary habits, metabolic diseases, obesity and environmental influence have augmented its overload. Positioning of the stone influences the symptoms, diagnosis, therapy and prognosis. There is limited local data concerning stone location in Pakistan. The purpose of this study was to establish the prevalence and distribution of urinary tract stones in hospital patients.

Methods: It is a cross-sectional study that was done at the Institute of Kidney Diseases (IKD), Peshawar, during the period May to July 2026. Two hundred and six patients who had a urinary stone that had been radiologically proven were included. There was the recording of demographic, clinical, imaging, and stone location and risk factor. The SPSS 26 was used to analyze the data, which were presented as means in SDs, frequencies, and percentages.

Results: 206 patients were studied with a mean of 42.7 ± 13.5 years and 64.1 percent men. Most common were renal and ureteric stones. The most frequent ones were lower calyceal and lower ureteric stones. The majority of stones were unilateral. Risk factors were low levels of fluid intake and high salt intake.

Conclusion: Urinary stones were predominant in middle-aged males with the predominant location renal and ureteric. Local stone patterns could assist in enhancing the diagnosis, treatment, and prevention.

Keywords: Kidney Calculi, Ureteral Calculi, Urolithiasis, Urinary Tract Calculi

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Introduction

The issue of urolithiasis is very prevalent in urology and still poses a significant burden of morbidity and utilization in health care in any part of the globe.

It is a condition that has been observed to have an extremely high number of victims and can lead to frequent visits to the hospital, reduced productivity, and high treatment fees (1, 2). In

recent decades the prevalence of urolithiasis has increased with changes in diet, increasing obesity, metabolic disorders, sedentary lifestyles and environmental factors playing a role (3, 4).

There are various genetic, metabolic, dietary and environmental factors which affect the formation of stones. Poor drinking of fluids and dehydration leads to higher levels of urinary concentration and is a significant factor in stone formation. An increased risk of urinary stones has also been linked to a high dietary intake of salt and animal protein, dieting (obesity), diabetes mellitus, and

metabolic syndrome (4, 5). This risk may also be affected by environmental conditions. Higher temperatures and climate changes that result in increased fluid loss and reduced urine volume have the potential of increasing the risk of stone formation (6, 7).

Urolithiasis is common in different geographical locations. The burden is high in countries that belong to the Afro-Asian stone belt, and all these factors may influence the prevalence of the diseases include climate, diet, and socioeconomic factors (8). A high-risk region of urinary stone disease is said to be the area of Pakistan and the local clinical research has given a substantial number of patients that need assessment and treatment of the urinary tract stones (5, 9).

The urinary stones may develop in various locations on the urinary system such as kidney, ureter, bladder, and urethra. The clinical significance of the stone site, lies in the fact that it may influence the symptoms, imaging modality of choice, the mode and the likelihood of developing complications (10). Renal stones may be asymptomatic or cause obstruction of urine, frequent infection, hydronephrosis and worsening of renal functions (11). Symptoms of ureteric stones are more frequently associated with acute pain in the flank, hematuria and obstructive symptoms and may necessitate early intervention (10).

Lithiasis related to the bladder and urethra is less common and may result in lower urinary tract symptoms, recurrent urinary infection, urinary retention, and the lack of quality of life (12). This is why locating an anatomical location of a urinary stone is a significant consideration in the diagnostic procedure and aids in choosing the right management (13).

The diagnosis and localization of urinary tract stones are mainly done through imaging. The first study is ultrasonography as it is a popular

technique that is not invasive, and patients are not exposed to ionizing radiation (14). However, non-contrast computed tomography of the bladder, ureters and kidneys (CT KUB) is more sensitive to the presence of urinary tract stones and also offers more information on the location of stones and their size. Thus, its application is prevalent in cases when specific quantities have to be measured (10, 14).

The pattern of distribution of urinary tract stones across various anatomical sites is uneven and could be susceptible to hydration, food intake, environmental contact, metabolism as well as healthcare accessibility (15, 16). Most urinary tract stones are usually renal and ureteral stones but bladder and urethral stones are not common (8, 17). Knowledge on the anatomical distribution of stones proves clinically beneficial since it aids clinicians to comprehend patterns of diseases in a region and it can be helpful to decide on their diagnosis and treatment methods (13).

Despite urinary stone disease being a significant health issue in Pakistan, little information exists that describe the anatomical location of stones in patients who attend special centers in Khyber Pakhtunkhwa. IKD of Peshawar is visited by patients with urinary stone disease from various regions of the province and this gives a chance to discuss the nature of the presentation of the disease in the patients. It is thus with an interest to ascertain the frequency and the distribution of the urinary tract stones in the selected patients who have presented to IKD Peshawar. The research also evaluated chosen demographic, clinical, imaging, and diet practices which could be helpful to explain the trend of stone disease in this environment.

Methods

The timeframe of this cross-sectional study was the Institute of kidney diseases (IKD), Peshawar between May 2026 and July 2026 following the consent of the study by the Institutional Ethical Review Committee of the Institute of kidney diseases, Peshawar (Approval No. 3038, dated 03/04/2026). Non probability consecutive sampling was used to enroll 206 patients. The WHO sample size calculator was used with the presumed prevalence of urinary tract stones 16, 95% confidence level and 5% margin of error in calculating the sample size. The subjects were adult patients (either sex) aged 18–75 years who received ultrasound or CT KUB because of a suspected urinary tract stone and provided an informed consent in writing. Pregnant women, patients with congenital renal anomaly (horseshoe kidney, duplex collecting system, etc.), patients who had undergone history of urological surgery with regard to urinary tract anatomy, and incomplete imaging or medical documentation were excluded.

Informed consent was taken and demographic/clinical data were recorded on a structured proforma. The data gathered comprised of age, gender, place of residence, presenting symptoms, the past history of urinary tract stones, hereditary history of stone disease, fluid intake pattern, dietary features, other co-morbidities, image modality, anatomical localization of stones, and laterality. The anatomical distribution of the urinary tract stones was determined by reviewing imaging findings provided by use of ultrasound and/or CT KUB. Renal pelvic stones comprised renal pelvic stones and ureteropelvic junction stones. Renal pelvic, upper calyceal, mid-calyceal, lower calyceal, upper ureteric, mid-ureteric, lower ureteric, vesicoureteric, bladder and urethral stones

were the categories in which stones were classified depending on their location.

Data were inputted with the use of SPSS 26 version and analyzed. The quantitative variables (age) were provided as a mean with a standard deviation, and the categorical variables were provided as frequencies and percentages. Gender stratification was done to determine its correlation with stone distribution in the anatomy. The Chi-square test has been applied where suitable and p-value less than 0.05 assumed to be statistically important.

Results

The study involved 206 patients who have confirmed urinary tract stones. The average age of the subjects was 42.7 and the variation was 13.5. The highest percentage of patients belonged to the age group 31–45 years (39.8%), then came 46–60 years (27.2%). The percentage of males and females in the study population was 64.1 and 35.9, respectively. The majority of the participants (62.1) lived in rural regions. The demographics are given in Table 1.

Table 1. Demographic Characteristics of Study Participants (n = 206)

Variable	Frequency (n)	% age
Age group		
18–30 years	48	23.3
31–45 years	82	39.8
46–60 years	56	27.2
>60 years	20	9.7
Gender		
Male	132	64.1
Female	74	35.9
Residence		
Urban	78	37.9
Rural	128	62.1

The most common presenting complaint was flank pain, identified in 85.4% of patients, then came hematuria (45.6) and dysuria (39.8%). Some patients (33.5 percent and 18.4 percent) experienced nausea or vomiting and fever respectively. Thirty-five percent of the sample

had a history of urinary stone disease previously and 28.2% stated that there was family history of stones. Seventy five percent of patients had hypertension and diabetes mellitus at rates of 26.2 and 18.9 percent, respectively, and 8.3 percent with chronic kidney disease. None of the patients had a history of gout.

In terms of hydration, only 56.8% of the patients said that they consumed 1-2 liters of water per day and the remaining 23.8% consumed less than that amount. Only 19.4% had a consumption of over 2 liters per day. Four 6.6% of people reported low fluid intake, and 34.5% and 21.4% reported high salt and protein intake respectively. Table 2 summarizes the clinical, comorbidity, hydration and dietary characteristics.

Table 2. Clinical, Comorbidity, Hydration and Dietary Characteristics of Study Participants (n = 206)

Variable	Frequency (n)	% age
Presenting symptoms		
Flank pain	176	85.4
Hematuria	94	45.6
Dysuria	82	39.8
Nausea/Vomiting	69	33.5
Fever	38	18.4
Previous history and comorbidities		
Previous stone history	72	35.0
Family history of stones	58	28.2
Hypertension	54	26.2
Diabetes mellitus	39	18.9
Chronic kidney disease	17	8.3
Daily water intake		
<1 liter/day	49	23.8
1-2 liters/day	117	56.8
>2 liters/day	40	19.4
Dietary characteristics		
High salt intake	71	34.5

High protein intake	44	21.4
Low fluid intake	96	46.6
Normal dietary habits	53	25.7

CT KUB was the most frequently used imaging modality, performed in 57.3% of patients, followed by ultrasonography in 35.9% and X-ray KUB in 6.8%. This distribution reflects the imaging investigations used for radiological confirmation and anatomical localization of the stones.

The majority of urinary tract stones comprised of renal and ureteric calculi. Lower calyceal stones were the most common out of renal stones, as 20.9 per cent of the study population were found to have lower calyceal stones, then there are renal pelvic stones (16.5%). Lower ureteric calculi were the most frequent ureteric stones (15.0%), up to upper ureteric stones (10.7%). Stones of the vesicoureteric junction were 5.8%. The prevalence of bladder stones was found in 3.9 percent of patients and no urethral stones were found in 200 days. Table 3 and Figure 1 display the entire anatomical distribution.

Table 3. Anatomical Distribution of Urinary Tract Stones (n = 206)

Anatomical Location	Frequency (n)	%
Renal pelvis	34	16.5
Upper calyx	21	10.2
Middle calyx	18	8.7
Lower calyx	43	20.9
Upper ureter	22	10.7
Mid ureter	17	8.3
Lower ureter	31	15.0
Vesicoureteric junction	12	5.8
Bladder	8	3.9
Urethra	0	0

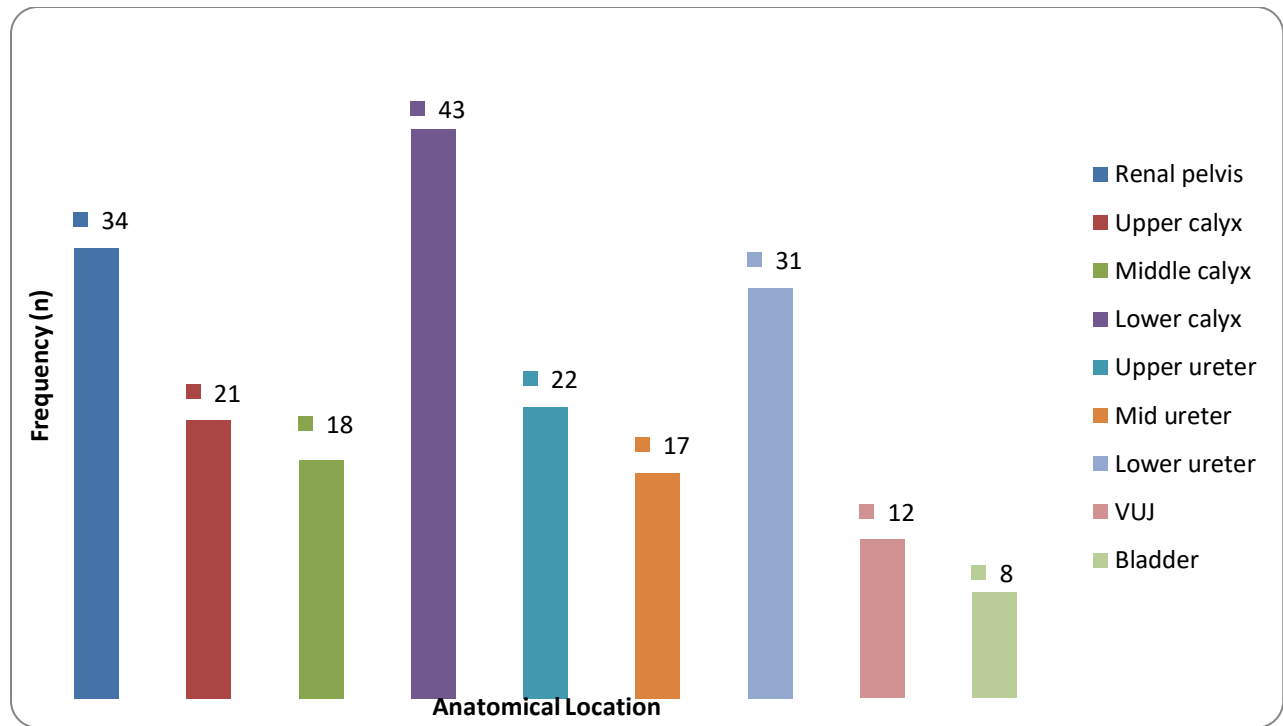


Figure 1: Distribution of Urinary Tract Stones According to Anatomical Location

Most stones were unilateral. Right-sided stones were identified in 44.7% of patients and left-sided stones in 39.3%, while bilateral involvement was present in 16.0% of cases. No separate figure or table was used for laterality because this was a secondary descriptive finding.

The stratification between males and females revealed that renal stones were relatively more common among males (59.1% vs. 51.4%), but ureteric stones were relatively more common among females (47.3% vs. 35.6%). Bladder stones were found in 5.3 percent of the male and 1.3 percent of the female sex. Nevertheless, the correlation between the genders and the distribution of the anatomical stones has not been statistically significant ($p = 0.28$) as presented in Table 4.

Table 4. Association Between Gender and Anatomical Distribution of Urinary Tract Stones

Stone Location	Male, n (%)	Female, n (%)
Renal stones	78 (59.1)	38 (51.4)
Ureteric stones	47 (35.6)	35 (47.3)
Bladder stones	7 (5.3)	1 (1.3)
Overall p-value	0.28	

Overall, urinary tract stones were most frequently observed among middle-aged male patients. Renal and ureteric calculi constituted the predominant stone locations, with lower calyceal and lower ureteric stones being the most common renal and ureteric sites, respectively. Low fluid intake and high salt consumption were also frequently reported among the study participants.

Discussion

The present study showed that urinary tract stones were seen predominantly in middle-aged adults and males, with renal and ureteric calculi accounting for most of the cases. The mode age stood at 42.7 ± 13.5 years with the greatest percentage of the patients falling within the 31-45 years. This trend is in line

with other reports that reveal that urolithiasis is a prevalent disease among adults in their productive age (1, 2, 6). Male dominance was also noted as a percentage of the study population is composed of 64.1% males. Other populations have also been reported to show similar male dominance and to some extent, they could be attributed to discrepancies in dietary may include occupational exposure of dehydration and lifestyle changes (7, 8).

The most common presenting symptom in this study was the flank pain that 85.4% of the patients reported, next were hematuria and dysuria. This goes together with the typical clinical manifestation of urinary stones especially where a calculus obstructs the ureters or results in renal colic (9, 10). Depending on the size and the location of the stone in the body and the extent of obstruction, the clinical manifestation of the disease can be different. The hematuria and dysuria frequency is also relatively high in the given study as it demonstrates the irritation of the urinary tract that can be followed in case of stone passage or obstruction.

The most common anatomical sites of our patients were renal and ureteric calculi. The renal stones had lower calyceal calculi that were the most frequently encountered (20.9 percent) then the renal pelvic stones (16.5 percent). Lower ureteric calculi were the most prevalent (15.0% of the study population) of ureteric stones. This distribution is widely in line with the findings where renal and ureteral stones make the significant percentage of urinary tract calculi (11, 12). In the current study, bladder stones were rare and were only present in 3.9 percent of them and there were no urethral stones. The vast majority of the stones were unilateral and the right-sided disease was a bit more prevalent than the left-sided one, with bilateral stones making up 16.0% of the case.

Another noteworthy finding was hydration. Over half of the patients reported consuming one to two liters of water daily, whereas 23.8% reported consuming less than one liter. Because decreased urine volume raises the concentration of lithogenic chemicals, low fluid intake is a known risk factor for the development of urinary stones (3, 13). Additionally, 34.5% of participants reported consuming a lot of salt. When fluid intake is insufficient, dietary sodium can increase the excretion of calcium in the urine, which may lead to the development of stones (4, 14). Low fluid intake and excessive salt consumption were typical findings in the current investigation, but a causal association between these parameters and stone formation cannot be proven due to the cross-sectional methodology.

Additionally, a number of comorbid conditions were found. Of the patients, 26.2% had hypertension, 18.9% had diabetes mellitus, and 8.3% had chronic kidney disease. Metabolic disorders linked to diabetes, hypertension, and other aspects of the metabolic syndrome have been linked to an increased risk of urolithiasis (15, 16). Even though the current investigation did not include a detailed biochemical or metabolic analysis, these findings indicate that the metabolic aspect and lifestyle could play a major role in evaluating persons with urinary stones. The applications in this study of the distribution of stones can be used in clinical evaluation. In most cases, bladder stones were not common as compared to renal and ureteric stones. Right anatomical localization is crucial in the choice of imaging, probability of spontaneous passage and treatment pathway. CT KUB led in this research with 57.3% while ultrasound operated with 35.9%. Despite the fact that ultrasonography still has some role as a preliminary examination as it produces minimum radiation leadership, the popularity

of CT KUB shows its worth in stone position and locate obstruction of the urinary tract.

Limitations of study:

The interpretations of the results are subject to a few limitations which are worth noting. The findings might not be a true representation of the distribution of stones in the overall population since it was a single-center study and the sample population utilized was a specialist in tertiary care. The absence of research on stone composition and on the particular metabolic disorders inhibited the deep comprehension of the underlying mechanisms of stone production. Further, patient reports on food practices and water consumption were collected, which might have been biased by memory. The trial, also, did not provide follow-up data, which could not assess the long-term effects and recurrence. Conclusively, the most frequent anatomy of urinary tract stones in middle-aged males were renal and ureteric. Although lower ureteric were the most common ureteric stones, lower calyceal stones were the most common renal calculi. Hydraulic needs and changes in diet of the patient at risk of developing urinary stone disease are most clearly noticeable, as the low fluid intake and excessive salt intake remains a frequent report. The etiology of the local urolithiasis distribution could be further clarified by further multicenter studies with metabolic screening and the composition of stones.

Conclusion

Urinary stones were predominant in middle-aged males with the predominant location renal and ureteric, with lower calyceal stones being the most common renal location and lower ureteric stones being the most common ureteric site. Participants commonly reported consuming a lot of salt and little water. Patients with diabetes mellitus and hypertension were also a percentage of the patients. These results underline how crucial it is for individuals at risk

of urinary stone disease to drink enough water, change their diet, and get checked out as soon as possible. Local stone patterns could assist the clinicians in enhancing the diagnosis, treatment, and prevention.

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Conflict of Interest

The authors declared no conflict of interest

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Manuscript writing and approval	SH,SMKS,IU
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