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Research Article

Clinical Profile and Outcomes of Urolithiasis in Patients Attending a Tertiary Care Hospital: A Prospective Observational Study

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Abstract: ***Introduction:*** Urolithiasis is a frequent urological disorder associated with pain, urinary obstruction, infection, impaired renal function, and recurrent healthcare use. Local prospective data describing its clinical spectrum and short-term treatment outcomes remain limited.**Objectives:** To evaluate the demographic and clinical profile, stone characteristics, treatment patterns, outcomes, and factors associated with stone clearance and complications among patients with urolithiasis.**Methods:** This prospective observational study included 50 adults with radiologically confirmed urolithiasis treated at the Department of Urology, Government General Hospital, Bhadradri Kothagudem, Telangana, India, from January to October 2024. Consecutively enrolled patients underwent clinical, laboratory, and radiological assessment and were followed for 12 weeks. Treatment was selected according to stone and patient characteristics. Descriptive statistics and Fisher's exact test were applied.**Results:** The mean age was 41.6 ± 13.8 years; 34 (68.0%) patients were male. Flank pain occurred in 44 (88.0%), and urine culture was positive in 10 (20.0%). Ureteric calculi were most frequent in 24 (48.0%), and hydronephrosis was present in 32 (64.0%). Conservative therapy was used in 18 (36.0%), ureteroscopic lithotripsy in 14 (28.0%), shock-wave lithotripsy in 8 (16.0%), percutaneous nephrolithotomy in 7 (14.0%), and cystolithotripsy in 3 (6.0%). Complete clearance was achieved in 43 (86.0%); complications occurred in 8 (16.0%). Stones ≤10 mm were associated with higher clearance, while positive urine culture was associated with complications.**Conclusion:** Urolithiasis predominantly affected middle-aged men and commonly presented with flank pain and ureteric stones. Individualised treatment achieved high short-term clearance with limited complications. Stone size and urinary infection were important outcome determinants.

Keywords: Urolithiasis; renal calculi; ureteric calculi; hydronephrosis; stone clearance; urinary tract infection

INTRODUCTION

Urolithiasis is characterised by the formation or presence of calculi within the kidney, ureter, urinary bladder, or urethra. It is a common urological disorder with substantial variation in prevalence across geographical regions, ethnic groups, climatic conditions, and dietary patterns. Population-based estimates indicate that kidney stone disease has increased over recent decades, with prevalence exceeding 8% in several adult populations.[1-3] The disorder is clinically important because it frequently produces acute renal colic, haematuria, nausea, urinary obstruction, infection, and repeated hospital visits. Recurrent stone formation is also frequent, and nearly half of affected individuals experience another episode within five years.[4]

Stone formation results from urinary supersaturation, crystal nucleation, growth, aggregation, and retention within the urinary tract. Calcium oxalate is the predominant stone constituent, although calcium phosphate, uric acid, struvite, and cystine stones also occur.[4,5] Low urine volume, inadequate fluid intake, high dietary sodium, obesity, diabetes mellitus, hypertension, metabolic abnormalities, urinary infection, anatomical obstruction, and genetic susceptibility contribute to stone development.[2,4,5] Warm climates and occupational heat exposure further increase risk through dehydration and concentrated urine, making urolithiasis particularly relevant in tropical regions. The relationship is bidirectional in some patients because stone disease is associated with recurrent urinary infection, renal parenchymal injury, and an increased long-term risk of chronic kidney disease.[6]

Clinical presentation ranges from incidental radiological detection to severe colicky flank pain accompanied by vomiting, haematuria, dysuria, fever, or acute kidney injury. The anatomical location, maximum diameter, degree of obstruction, infection status, renal function, symptom burden, and patient preference guide management. Small uncomplicated ureteric stones can be managed through observation, hydration, analgesia, and medical expulsive therapy.[6,7] Larger, obstructing, infected, or persistent calculi generally require active intervention using shock-wave lithotripsy, ureteroscopy, percutaneous nephrolithotomy, or cystolithotripsy.[7-9] Contemporary minimally invasive techniques have improved stone-free rates and reduced morbidity; however, outcomes continue to vary with stone size, location, burden, hydronephrosis, infection, and procedural selection.[7-10]

Prospective hospital-based evidence from district-level tertiary institutions in Telangana remains limited. Describing the presenting profile and real-world management outcomes in such settings can support early recognition, rational allocation of endourological services, risk stratification, preventive education, follow-up planning, and patient counselling. Local data are also essential for comparing conservative and procedural outcomes under routine service conditions. Therefore, the present study was conducted to determine the demographic and clinical profile of patients with urolithiasis, describe the anatomical and radiological stone characteristics, document treatment modalities and 12-week outcomes, and evaluate factors associated with complete stone clearance and treatment-related complications at a tertiary care hospital.

MATERIALS AND METHODS

Study design and setting: This prospective observational study was conducted in the Department of Urology, Government General Hospital, Bhadradri Kothagudem, Telangana, India. The study period extended from January 2024 to October 2024. Patient recruitment was undertaken from January to July 2024, allowing completion of the planned 12-week follow-up by October 2024.

Study population: Adults aged 18 years or older presenting to the urology outpatient department or emergency service with symptoms suggestive of urolithiasis and radiological confirmation of a renal, ureteric, or vesical calculus were eligible. Patients who were pregnant, had known urinary tract malignancy, required immediate referral for complex reconstructive management, declined consent, or could not complete follow-up were excluded. Consecutive eligible patients were enrolled to reduce selection bias.

Sample size and sampling: Assuming an anticipated complete stone-clearance proportion of 85%, a 95% confidence level, and 10% absolute precision, the minimum calculated sample size was 49. This was rounded to 50 participants. A consecutive sampling technique was used.

Data collection and assessment: A structured case-record form captured age, sex, residence, symptom duration, previous or family history of stones, daily water intake, comorbidities, presenting symptoms, and physical findings. Laboratory investigations included urinalysis, urine microscopy, urine culture, complete blood count, serum creatinine, and other biochemical tests when clinically indicated. Stone location, laterality, number, maximum diameter, and hydronephrosis were assessed using ultrasonography of the kidney-ureter-bladder region. Non-contrast computed tomography was performed when the diagnosis, stone burden, obstruction, or treatment planning required further definition. Diagnostic and management decisions followed established urolithiasis principles.[6-9]

Treatment and follow-up: Treatment was determined by the treating urologist according to stone size and location, symptom severity, obstruction, infection, renal function, patient preference, and available expertise. Options included conservative treatment or medical expulsive therapy, extracorporeal shock-wave lithotripsy, ureteroscopic lithotripsy, percutaneous nephrolithotomy, and cystolithotripsy. Patients with urinary infection received culture-guided antibiotics. Follow-up assessments were performed according to treatment needs and completed at 12 weeks using clinical review and imaging.

Outcome definitions: Complete stone clearance was defined as absence of a detectable residual calculus on follow-up imaging. Clinically insignificant residual fragments were asymptomatic, non-obstructing fragments measuring 4 mm or less. Persistent stones included residual calculi requiring further intervention. Complications, readmissions, renal-function changes, and mortality were recorded.

Statistical analysis: Data were analysed using descriptive statistics. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, while categorical variables were presented as frequency and percentage. Fisher's exact test evaluated associations involving small expected cell frequencies. A two-sided p-value below 0.05 was considered statistically significant.

Ethical considerations: Necessary Permissions were obtained before starting the study. Written informed consent was obtained from every participant. Confidentiality was maintained through coded data collection, restricted database access, and reporting of aggregated findings.

RESULTS

Participant recruitment and baseline characteristics

A total of 56 patients with clinically suspected urolithiasis were assessed during the study period. Four patients did not satisfy the eligibility criteria, and two declined participation. The remaining 50 patients were enrolled and included in the final analysis. Complete clinical, radiological, treatment, and 12-week follow-up data were available for all participants.

The mean age of the study population was 41.6 ± 13.8 years, with an age range of 18-72 years. Most patients were between 31 and 50 years of age. There were 34 (68.0%) males and 16 (32.0%) females, giving a male-to-female ratio of 2.1:1. Twenty-nine (58.0%) participants were from rural areas. A previous history of urolithiasis was documented in 13 (26.0%), and 8 (16.0%) reported a family history of urinary stone disease. Daily water intake below 2 litres was reported by 31 (62.0%) participants. Hypertension and diabetes mellitus were present in 13 (26.0%) and 8 (16.0%) patients, respectively (Table 1).

Table 1. Demographic and baseline characteristics of the study participants (N=50)

Characteristic	Frequency/Mean	Percentage
Age, years, mean ± SD	41.6 ± 13.8	-
Age ≤30 years	10	20.0
Age 31-40 years	14	28.0
Age 41-50 years	12	24.0
Age 51-60 years	8	16.0
Age >60 years	6	12.0
Male sex	34	68.0
Female sex	16	32.0
Rural residence	29	58.0
Previous history of urolithiasis	13	26.0
Family history of urolithiasis	8	16.0
Daily water intake <2 litres	31	62.0
Hypertension	13	26.0
Diabetes mellitus	8	16.0

Clinical presentation

Flank pain was the most frequent presenting symptom and was reported by 44 (88.0%) patients. Haematuria was observed in 18 (36.0%), dysuria in 15 (30.0%), and nausea or vomiting in 14 (28.0%) patients. Eight (16.0%) presented with fever, while urolithiasis was detected incidentally in 3 (6.0%) patients during imaging performed for unrelated complaints.

The median duration of symptoms before presentation was 4 days (interquartile range, 2-8 days). Costovertebral angle tenderness was noted in 32 (64.0%) patients. Serum creatinine above the institutional upper reference limit was observed in 12 (24.0%), and pyuria was detected in 14 (28.0%). Urine culture was positive in 10 (20.0%) patients. Escherichia coli was the most frequently isolated organism, accounting for 6 of the 10 culture-positive cases (Table 2).

Table 2. Clinical and laboratory profile of the participants

Clinical or laboratory characteristic	Frequency	Percentage
Flank pain	44	88.0
Haematuria	18	36.0
Dysuria	15	30.0
Nausea or vomiting	14	28.0
Fever	8	16.0
Incidental detection	3	6.0
Costovertebral angle tenderness	32	64.0
Elevated serum creatinine	12	24.0
Pyuria	14	28.0
Positive urine culture	10	20.0

Radiological and stone characteristics

Ureteric calculi were the most common and were identified in 24 (48.0%) patients, followed by renal calculi in 22 (44.0%) and vesical calculi in 4 (8.0%). Stones were right-sided in 22 (44.0%) and left-sided in 24 (48.0%), while bilateral stones were present in 4 (8.0%).

A single calculus was identified in 40 (80.0%) patients, whereas 10 (20.0%) had multiple calculi. The mean maximum stone diameter was 9.8 ± 5.2 mm. Thirty-three (66.0%) patients had stones measuring 10 mm or less, while 17 (34.0%) had stones larger than 10 mm. Hydronephrosis was present in 32 (64.0%) patients; it was mild in 15 (30.0%), moderate in 11 (22.0%), and severe in 6 (12.0%) patients (Table 3).

Table 3. Radiological and stone-related characteristics

Characteristic	Frequency	Percentage
Anatomical location		
Renal calculus	22	44.0
Ureteric calculus	24	48.0
Vesical calculus	4	8.0
Laterality		
Right-sided	22	44.0
Left-sided	24	48.0
Bilateral	4	8.0
Number of stones		
Single	40	80.0
Multiple	10	20.0
Maximum stone size, mm, mean ± SD	9.8 ± 5.2	-
Stone size <5 mm	9	18.0
Stone size 5-10 mm	24	48.0
Stone size 11-20 mm	13	26.0
Stone size >20 mm	4	8.0
Hydronephrosis		
Absent	18	36.0
Mild	15	30.0
Moderate	11	22.0
Severe	6	12.0

Treatment profile and outcomes

Conservative treatment, including hydration, analgesics, dietary advice, and medical expulsive therapy when indicated, was provided to 18 (36.0%) patients. Ureteroscopic lithotripsy was performed in 14 (28.0%), extracorporeal shock-wave lithotripsy in 8 (16.0%), percutaneous nephrolithotomy in 7 (14.0%), and cystolithotripsy in 3 (6.0%) patients. Treatment selection was based on stone size, anatomical location, obstruction, renal function, infection, symptom severity, and the treating urologist's clinical judgement.

Complete stone clearance was achieved in 43 (86.0%) patients by the end of 12 weeks. Five (10.0%) patients had clinically insignificant residual fragments, while 2 (4.0%) had persistent stones requiring an additional intervention. Among the 18 patients receiving conservative treatment, spontaneous passage was documented in 13 (72.2%). Complete clearance was achieved in 7 of 8 (87.5%) patients treated with shock-wave lithotripsy and in 13 of 14 (92.9%) undergoing ureteroscopic lithotripsy. All patients treated with percutaneous nephrolithotomy or cystolithotripsy achieved complete clearance.

Renal function improved in 10 of the 12 patients who had elevated serum creatinine at presentation. Treatment-related complications occurred in 8 (16.0%) patients, comprising transient fever in 3 (6.0%), urinary tract infection in 2 (4.0%), transient haematuria in 2 (4.0%), and steinstrasse after shock-wave lithotripsy in 1 (2.0%). All complications were managed conservatively or with appropriate antibiotics. Two patients were readmitted. No patient developed ureteric perforation or septic shock, required intensive-care admission, or died during follow-up (Table 4).

Table 4. Treatment modalities and clinical outcomes

Treatment or outcome	Frequency	Percentage
Treatment modality		
Conservative/medical expulsive therapy	18	36.0
Extracorporeal shock-wave lithotripsy	8	16.0
Ureteroscopic lithotripsy	14	28.0
Percutaneous nephrolithotomy	7	14.0
Cystolithotripsy	3	6.0
Outcome at 12 weeks		
Complete stone clearance	43	86.0
Clinically insignificant residual fragments	5	10.0
Persistent stone requiring additional treatment	2	4.0
Improvement in impaired renal function	10/12	83.3
Any treatment-related complication	8	16.0
Readmission during follow-up	2	4.0
Mortality	0	0.0

Factors associated with stone clearance and complications

Complete stone clearance was significantly more frequent among patients with stones measuring 10 mm or less than among those with stones larger than 10 mm: 31 of 33 (93.9%) versus 12 of 17 (70.6%), respectively (Fisher's exact test, p=0.037). Patients with absent or mild hydronephrosis had a higher clearance rate than those with moderate or severe hydronephrosis, but the difference was not statistically significant: 30 of 33 (90.9%) versus 13 of 17 (76.5%), respectively (p=0.210).

Treatment-related complications were more frequent among patients with a positive urine culture than among those with a negative culture: 4 of 10 (40.0%) versus 4 of 40 (10.0%), respectively. This association was statistically significant (Fisher's exact test, p=0.041) (Table 5).

Table 5. Factors associated with complete stone clearance and treatment-related complications

Factor	Outcome present, n (%)	Outcome absent, n (%)	p-value
Complete stone clearance			
Stone size ≤10 mm (n=33)	31 (93.9)	2 (6.1)	0.037
Stone size >10 mm (n=17)	12 (70.6)	5 (29.4)	
Absent/mild hydronephrosis (n=33)	30 (90.9)	3 (9.1)	0.210
Moderate/severe hydronephrosis (n=17)	13 (76.5)	4 (23.5)	
Treatment-related complications			
Positive urine culture (n=10)	4 (40.0)	6 (60.0)	0.041
Negative urine culture (n=40)	4 (10.0)	36 (90.0)	

Fisher's exact test was used because of small expected frequencies in selected cells.

Overall, urolithiasis predominantly affected middle-aged males and most frequently presented with flank pain. Ureteric stones were the most common anatomical type. Complete stone clearance was achieved in most patients with a low rate of treatment-related complications. Larger stone size was associated with reduced clearance, whereas urinary infection was associated with a higher risk of complications.

DISCUSSION

The present prospective study describes the clinical spectrum, treatment pattern, and short-term outcomes of urolithiasis in a district tertiary-care setting. Participants had a mean age of 41.6 years, and more than two-thirds were male. This distribution is consistent with the recognised concentration of stone disease during economically productive adult years and the historically higher burden among men. Global epidemiological studies have nevertheless documented a narrowing sex difference, probably reflecting changing dietary, metabolic, and occupational exposures.[1-4] The high proportion of rural residents and patients reporting daily water intake below 2 litres highlights the relevance of hydration, heat exposure, and access to preventive counselling in this population.

Flank pain was the leading symptom, followed by haematuria, dysuria, and gastrointestinal symptoms. This pattern reflects ureteric obstruction and acute upper urinary tract irritation.[6] Ureteric calculi were slightly more frequent than renal calculi, while vesical stones accounted for a smaller proportion. Hydronephrosis was detected in nearly two-thirds of patients, indicating that a substantial number presented after obstruction had developed. The presence of elevated serum creatinine in 24% further demonstrates the clinical importance of timely decompression or definitive treatment. Kidney stone disease is associated with renal functional impairment and a higher long-term risk of chronic kidney disease, particularly when obstruction, infection, diabetes, or recurrent episodes coexist.[11]

One-fifth of participants had a positive urine culture, and Escherichia coli was the predominant isolate. Although urease-producing organisms are classically associated with struvite calculi, metabolic stones can also coexist with infection caused by common Enterobacterales.[12] Infection in the presence of an obstructed collecting system requires prompt recognition because delayed treatment can progress to severe sepsis. In this study, culture positivity was significantly associated with treatment-related complications, supporting routine urinalysis, urine culture in clinically suspected infection, and culture-directed antimicrobial therapy before intervention.

Management was individualised according to stone and patient characteristics. More than one-third received conservative treatment, and approximately three-quarters of these patients achieved spontaneous passage. Published evidence consistently shows that spontaneous passage declines as stone diameter increases and varies by ureteric location.[10,13,14] The present finding that stones measuring 10 mm or less had a significantly higher clearance rate supports size-based treatment selection. Patients with moderate or severe hydronephrosis had a numerically lower clearance rate, although the difference was not statistically significant, possibly because of the limited sample.

Overall complete clearance reached 86%, and all patients treated with percutaneous nephrolithotomy or cystolithotripsy achieved clearance at 12 weeks. Modern guidance recommends selection among shock-wave lithotripsy, ureteroscopy, and percutaneous nephrolithotomy according to stone burden, anatomy, obstruction, infection, comorbidity, and patient preference.[7-9] Complications were generally minor and resolved with conservative measures or antibiotics. The absence of septic shock, intensive-care admission, or mortality indicates favourable short-term safety within the observed cohort. These findings support structured evaluation, early infection control, and tailored minimally invasive treatment in tertiary urological practice.

LIMITATIONS

This study was limited by its single-centre design, modest sample size, and 12-week follow-up, restricting assessment of recurrence and long-term renal outcomes. Stone composition and complete metabolic evaluation were unavailable for every participant. Treatment allocation was observational and based on clinical judgement, preventing direct comparative efficacy conclusions. Residual fragments were assessed using routine imaging rather than uniform computed tomography in all patients.

CONCLUSION

Urolithiasis in this tertiary-care cohort predominantly affected middle-aged men and most often presented with flank pain. Ureteric calculi and hydronephrosis were common, while one-fifth of patients had culture-confirmed urinary infection. Individualised conservative and minimally invasive treatment produced complete stone clearance in most participants with few serious adverse outcomes. Smaller stones were associated with superior clearance, whereas positive urine culture increased the risk of treatment-related complications. Early radiological assessment, evaluation of renal function, urine culture in suspected infection, and treatment selection according to stone burden remain essential. Patient education should emphasise adequate fluid intake, timely consultation for obstructive symptoms, adherence to follow-up, and preventive evaluation after the acute episode during follow-up.

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