



Original Article

Management Modalities and Outcome of Ureteric Calculi at a Tertiary Care Centre: A Prospective Study

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ABSTRACT

Background: Ureteric calculi are a common cause of urinary tract obstruction, and treatment selection depends on stone size, renal function, and the availability of appropriate interventions. This study evaluated the management modalities and treatment outcomes of ureteric calculi at a tertiary care centre.

Material and Methods: This prospective observational study was conducted in the Department of General Surgery at C. U. Shah Medical College and Shrimad Rajchandra Sarvamangal Hospital, Surendranagar, Gujarat, from March 2024 to March 2025. A total of 100 patients were included. Clinical and radiological findings guided treatment selection, including oral and intravenous hydrotherapy, ureteroscopy with pneumatic lithotripsy and double-J (DJ) stenting, percutaneous nephrolithotomy (PCNL), and open ureterolithotomy. Stone clearance, time to passage, operative duration, and complications were assessed.

Results: Oral hydrotherapy was administered to 50 patients, achieving stone clearance in 45 (90%). Among these, clearance rates were 100% for stones smaller than 2 mm and 2–4 mm, and 92.3% for 5–7 mm stones. Intravenous hydrotherapy resulted in stone passage in 17 of 19 patients (89.47%). Ureteroscopy achieved clearance in 25 of 27 patients (92.59%), with a mean operative time of 43 minutes. Post-procedural complications included haematuria and urinary tract infection in two patients each (7.4%) and renal colic in one (3.7%); no ureteric avulsion or perforation occurred. PCNL achieved clearance in 9 of 10 patients (90%), whereas open ureterolithotomy cleared stones in all four patients (100%). ESWL was not performed.

Conclusion: Stone-size-guided management achieved favourable clearance rates across treatment modalities, with ureteroscopy providing effective definitive treatment for larger calculi.

Keywords: Ureteric calculi; Medical management; Ureteroscopy; Pneumatic lithotripsy; Stone clearance; Treatment outcome.

INTRODUCTION

Ureteric calculi are an important cause of acute renal colic, urinary tract obstruction, and healthcare utilisation. The clinical consequences depend on stone size and location, the degree of obstruction, and the presence of associated infection or impaired renal function. Management therefore requires an individualised approach that balances the likelihood of spontaneous stone passage against the risks of persistent obstruction and the need for definitive intervention. Recent evidence continues to examine the relative roles of conservative management, medical expulsive therapy, and minimally invasive procedures in achieving satisfactory stone clearance [1,2].

Conservative treatment is appropriate for selected patients with small ureteric stones when pain is controlled, renal function is preserved, and there is no evidence of significant infection or other complications. Medical expulsive therapy, particularly with alpha-adrenergic blockers such as tamsulosin, may facilitate stone passage in suitable patients, although its benefits vary with stone characteristics and the treatment regimen. A recent systematic review and network meta-analysis reported improved stone expulsion rates with certain combinations of medications compared with alpha-blocker monotherapy, highlighting the continuing interest in optimising non-operative treatment [1]. Nevertheless, conservative management requires clinical monitoring because persistent obstruction, infection, or deterioration in renal function may necessitate prompt intervention.

Active treatment is indicated when spontaneous passage is unlikely, symptoms remain uncontrolled, or obstruction threatens renal function. Ureterscopy enables direct visualisation and fragmentation or extraction of the calculus, while extracorporeal shock wave lithotripsy offers a non-invasive alternative where available and clinically appropriate. Comparative evidence indicates that ureteroscopy can achieve higher early stone-free rates and reduce the need for retreatment, although treatment selection must also account for procedural risks and resource availability [3,4]. Recent clinical studies have also examined early ureteroscopic intervention as an alternative to an initial period of medical expulsive therapy, underscoring the importance of patient preferences and the likelihood of achieving clearance with a single procedure [5,6].

Despite advances in endourological techniques, the optimal management strategy depends on the clinical presentation, stone characteristics, renal function, and local facilities. Evidence from individual centres is therefore useful for understanding treatment patterns and outcomes in specific healthcare settings. The present study was undertaken to evaluate the management modalities used for ureteric calculi at a tertiary care centre and assess their outcomes in terms of stone clearance, time to passage with conservative treatment, operative duration, and post-procedural complications.

MATERIALS AND METHODS

Study design and setting: This hospital-based observational study was conducted in the Department of General Surgery at C. U. Shah Medical College and Shrimad Rajchandra Sarvamangal Hospital, Surendranagar, Gujarat, India, a tertiary care teaching hospital. The study period was March 2024 to March 2025. The protocol was approved by the Institutional Scientific Committee and the Institutional Ethics Committee [CUSMC/IEC(HR)/DI/59/2024/Fina Approval/185/2024; Dated:23/07/2024].

Study population: Patients with clinical features suggestive of ureteric calculi who attended the outpatient department and were investigated, diagnosed and treated at the hospital during the study period were included. All diagnosed cases of ureteric stones were eligible, and no exclusion criteria were applied. The sample size was 100 cases.

Diagnostic evaluation: All patients were examined clinically and investigated with routine pre-operative blood tests, urine analysis with culture and sensitivity, plain X-ray of the kidneys, ureters and bladder (KUB), and ultrasonography of the abdomen. The diagnosis of ureteric stone was confirmed, and stone size, back-pressure changes and laterality (unilateral or bilateral) were recorded. Intravenous urography (IVU) was performed to assess renal function and the exact location of the stone; it was not performed in patients with serum creatinine of 2 mg/dL or more. Data were recorded on a predesigned proforma. Treatment protocol Treatment was allocated according to stone size, renal function and response to initial therapy, as follows (Figure 1).

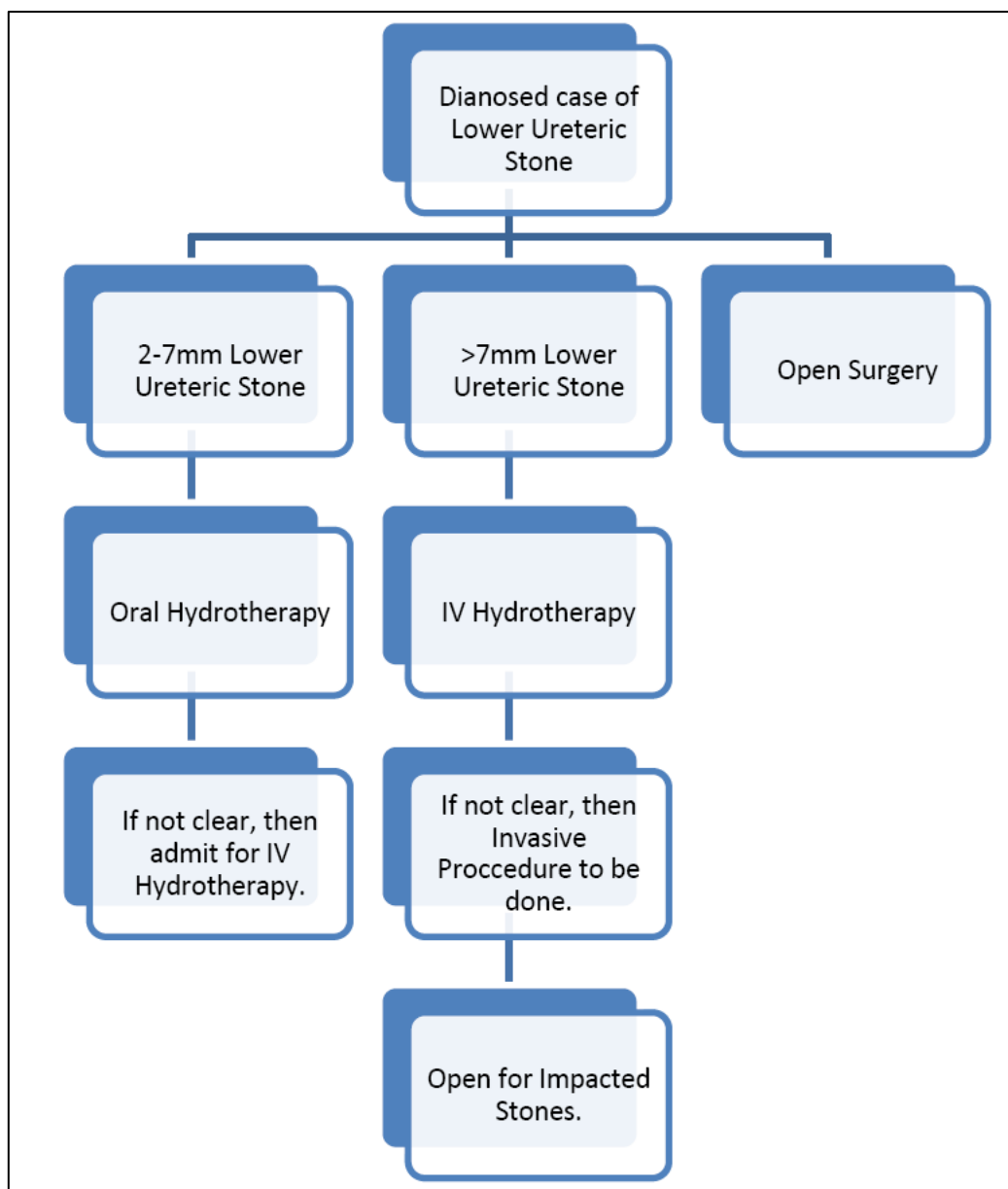


Figure 1: Treatment Protocol

Oral hydrotherapy on an outpatient basis. Patients with stones of 2 to 7 mm and a functioning kidney were treated as outpatients for up to four weeks. Treatment consisted of oral fluids, diuretics, antispasmodics (hyoscine butylbromide), Syrup Cystone, an oral analgesic (diclofenac sodium) and tamsulosin 0.4 mg. Antibiotics were given according to urine culture. Patients were advised to watch for passage of the stone per urethram. They were followed up weekly, and stone clearance and the number of days to clearance were confirmed by ultrasonography and X-ray KUB. Patients with no stone clearance were admitted for further treatment.

Intravenous hydrotherapy. Patients who did not respond to oral therapy, or whose stone size was borderline with good renal function, were admitted and given intravenous fluids, diuretics and antispasmodics under observation. Strong analgesics and antibiotics were given when required. Stone passage was recorded, and follow-up X-ray KUB was used to confirm clearance.

Invasive procedures. Patients who did not respond to conservative management, had large stones (approximately more than 10 mm), or had impaired renal function underwent invasive treatment. Ureterscopy was performed with a rigid ureterscope. Stones were fragmented with a pneumatic lithotripter, and fragments were retrieved with forceps or a dormia basket where needed. A double-J (DJ) stent was placed in all patients after the procedure, and was kept in situ for 21 days

after pneumatic lithotripsy. Operative time was recorded. Percutaneous nephrolithotomy (PCNL) and open ureterolithotomy were performed in the remaining patients. Open ureterolithotomy was also used when other procedures failed. Extracorporeal shock wave lithotripsy (ESWL) was not available at the centre and was not used [confirm].

Outcome measures: The primary outcome was stone clearance (the proportion of patients who became stone free) for each treatment modality, with the number of non-responders. Secondary outcomes were the mean time to stone passage with medical therapy, the stone-free rate and operative time for ureteroscopy, and post-procedural complications (haematuria, urinary tract infection, ureteric avulsion, ureteric perforation and renal colic). Patients were grouped by stone size for analysis, as shown in Tables 1 and 2.

Statistical analysis: Data were analysed with SPSS software. Categorical variables are presented as frequencies and percentages, and the time to stone passage was presented as mean $\pm$ standard deviation. Chi-square or Fisher's exact test was used as appropriate. A p value of <0.05 was taken as significant.

RESULTS

Table 1. Stone size by treatment setting

Treatment setting	Size of stones	No. of patients	Percentage
OPD (medical therapy), n = 50	< 2 mm	8	16%
	2-4 mm	16	32%
	5-7 mm	26	52%
Indoor (IPD) treatment, n = 55	5-10 mm	29	52%
	11-15 mm	15	28%
	16-22 mm	11	20%
	Total	55	100%

Table 2. Stone clearance and time to expulsion with medical therapy

Size of stones	No. of stones	No. of stones cleared	Stone clearance rate	Mean no. of days for passage
< 2 mm	8	8	100%	8 $\pm$ 2 days
2-4 mm	16	16	100%	13 $\pm$ 2 days
5-7 mm	26	24	92.30%	22 $\pm$ 4 days

Table 3. Intravenous hydrotherapy

I/V hydrotherapy given	Stone passed	Percentage
19 patients (19%)	17	89.47%

Table 4. Ureteroscopic procedures: procedure type, stone-free rate and operative time

Parameter	Category	No. of cases	Percentage / Result
Procedure used (n = 27)	Pneumatic lithotripsy with DJ stenting	23	85.18%
	Pneumatic lithotripsy with dormia with DJ stenting	04	14.72%
Stone-free rate	11-15 mm (17 cases, 1 failed attempt)	17	94.11%
	16-22 mm (10 cases, 1 failed attempt)	10	90%
Operative time	20-30 min	13	
	30-40 min	5	
	40-50 min	3	
	50-60 min	3	
	60-70 min	2	
	70-80 min	1	
	Mean operating time		43 min

Table 5. Post-procedural complications of ureteroscopy (n = 27)

Complication	No. of cases	Percentage
Hematuria	02	7.40%
UTI	02	7.40%
Avulsion of ureter	00	0
Ureteric perforation	00	0
Renal colic	01	3.70%

Table 6. Patients treated with various modalities

Modality of treatment	No. of patients	Not responded	Stone clearance (n)	Percentage
Oral hydrotherapy	50	5	45	90%
Intravenous hydrotherapy	19	2	17	89.47%
Ureteroscopy with intracorporeal lithotripsy with DJ stenting	27	2	25	92.59%
ESWL	Nil	Nil	Nil	
Open ureterolithotomy	4	0	4	100%
PCNL	10	1	9	90%

DISCUSSION

This prospective study found stone clearance rates of 89.47%–100% across treatment modalities for ureteric calculi. Conservative management was effective for smaller stones, while ureteroscopy with pneumatic lithotripsy and DJ stenting provided definitive treatment when intervention was required. Treatment selection should consider stone characteristics, renal function, clinical status, and available facilities. The findings warrant cautious interpretation given the small sample size and non-randomized treatment allocation.

Oral hydrotherapy was administered to 50 patients, of whom 45 achieved stone clearance, corresponding to a success rate of 90%. Clearance was 100% for stones smaller than 2 mm and those measuring 2–4 mm, while 24 of 26 patients with stones measuring 5–7 mm achieved clearance (92.30%). The mean time to passage increased with stone size, from 8 ± 2 days for stones smaller than 2 mm to 13 ± 2 days for 2–4 mm stones and 22 ± 4 days for 5–7 mm stones. This pattern suggests that stone size is an important consideration when estimating the likely duration and success of conservative treatment. Recent research examining medical expulsive therapy has similarly highlighted the importance of stone characteristics and treatment duration when determining whether continued observation is appropriate [7,8].

Conservative management achieved a 92.30% clearance rate for 5–7 mm stones, while intravenous hydrotherapy resulted in stone passage in 17 of 19 patients (89.47%). However, the small sample size, absence of a control group, and non-randomized treatment allocation limit these findings. As multiple supportive therapies were used, their individual contributions cannot be determined. Conservative treatment may be appropriate for selected patients with regular follow-up, while intravenous fluids should be administered according to hydration status and clinical need rather than routinely to promote stone passage.

The findings also emphasise the importance of defining when conservative treatment should be discontinued. In patients with persistent obstruction, uncontrolled pain, infection, or deteriorating renal function, further observation may be inappropriate. Accordingly, the potential benefit of avoiding surgery must be balanced against the risks associated with delayed definitive treatment [7].

Ureteroscopy with pneumatic lithotripsy and DJ stenting achieved stone clearance in 25 of 27 patients (92.59%), with rates of 94.11% for 11–15 mm stones and 90% for 16–22 mm stones. The mean operative duration was 43 minutes. However, unsuccessful clearance in two patients highlights potential procedural limitations. These findings align with evidence supporting ureteroscopy as an effective treatment, although stone-free rates vary with stone size, location, surgical technique, and outcome definitions [8]. The higher clearance rate observed in the present study may reflect differences in patient selection, stone characteristics, follow-up imaging, and outcome definitions; direct comparison between these figures is therefore inappropriate.

The present study used a rigid ureteroscope and pneumatic lithotripsy, with fragment retrieval where required and postoperative DJ stenting. Contemporary comparative research has continued to investigate ureteroscopic techniques and perioperative strategies, including the timing of intervention and the choice of lithotripsy method [9,10]. The findings support the utility of ureteroscopy in appropriately selected patients, but the absence of a comparator group prevents conclusions about its superiority over other surgical modalities at this centre.

The overall complication profile following ureteroscopy was favourable. Haematuria and urinary tract infection were each recorded in two patients (7.40%), while renal colic occurred in one patient (3.70%). No ureteric avulsion or perforation was documented. These findings suggest that ureteroscopy was associated with a low observed frequency of major ureteric injuries in this cohort. However, the absence of such events among 27 patients should not be interpreted as proof that these complications cannot occur. Larger studies have reported ureteric injuries and other adverse events during endourological procedures, with risk influenced by procedural technique and patient characteristics [11]. Furthermore, because all patients

in the present study received DJ stents, the independent effect of stenting on postoperative outcomes could not be evaluated. The duration of stent placement and subsequent removal should also be considered when assessing the overall treatment burden.

PCNL achieved stone clearance in nine of ten patients (90%), while all four patients undergoing open ureterolithotomy achieved clearance (100%). These results indicate that both procedures contributed to the management of selected patients in whom other treatment approaches were unsuitable or unsuccessful. However, the small number of patients undergoing open surgery limits the generalisability of its observed success rate. Similarly, the PCNL findings should be interpreted in relation to stone size, location, impaction, and the reasons for selecting this approach.

Recent comparative research involving large, impacted proximal ureteric stones has evaluated ureteroscopic, percutaneous, and laparoscopic approaches, demonstrating that treatment outcomes differ according to procedural route and stone characteristics [12,13]. These studies support the role of alternative surgical approaches in selected complex cases but do not establish that PCNL or open ureterolithotomy should routinely replace ureteroscopy. In the present study, ESWL was not used because it was unavailable at the study centre. Consequently, the findings reflect treatment outcomes within the resources of this institution rather than a comparison of all available treatment modalities.

Several limitations should be acknowledged. First, the study was conducted at a single tertiary care centre, limiting external generalisability. Second, the sample size was modest, particularly for PCNL and open ureterolithotomy. Third, the lack of randomisation and a standardised comparison group limits causal interpretation. Fourth, the available results do not provide a uniform definition of stone-free status or a consistent long-term follow-up period across treatment modalities. Finally, discrepancies in the reported patient totals across the study tables require verification before publication. Future prospective studies with clearly defined eligibility criteria, standardised imaging-based outcome assessment, and longer follow-up would help clarify the comparative effectiveness, safety, and resource requirements of different management strategies.

CONCLUSION

A stepwise, stone-size-guided approach to ureteric calculi is effective at a tertiary care centre. Conservative management with hydration, antispasmodics, analgesics and an alpha-blocker is safe and practicable in most patients with smaller stones, provided pain and infection remain under control, and intravenous hydrotherapy offers a further non-operative option before intervention is considered. Ureteroscopy with pneumatic lithotripsy is a safe, simple and effective method for larger or impacted stones and is well suited to patients who want definitive treatment in a single sitting. PCNL and open ureterolithotomy remain necessary for selected patients and for failures of other modalities. The choice of treatment should be individualised to stone size, renal function, available equipment and surgeon experience, with the aim of achieving stone clearance with minimal morbidity. Prospective comparative studies with standardised definitions of stone-free status and longer follow-up are needed to confirm these findings.

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