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Treatment Strategies and Postoperative Outcomes in Renal Stone Disease: A 46-Patient Study

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***Abstract** : **Objective :** This study aims to analyze the epidemiological, clinical, and therapeutic aspects of renal stone disease in a cohort of patients, highlighting the treatment approaches and outcomes.**Methods:** A retrospective study was conducted on 46 patients diagnosed with renal lithiasis. Epidemiological data, clinical presentation, imaging findings, and treatment strategies were analyzed. **Results:** The study included 20 men and 26 women, with a mean age of 57.6 years. The most common symptom was lower back pain (90%), followed by urinary disorders (39%) and hematuria (22%). Kidney stones were unilateral in 78% of cases and bilateral in 22%, with an average stone size of 38 mm. The primary treatment approaches included ureteroscopy, percutaneous nephrolithotomy, laparoscopic surgery, and open surgery, depending on stone size, location, and complexity. Postoperative complications were observed in 31% of cases, including infections (11%), residual lithiasis (7%), and acute kidney injury (7%). The overall recurrence rate was 7%.**Conclusion :** Despite advancements in minimally invasive techniques, the management of renal stones remains challenging, particularly in resource-limited settings. The study emphasizes the need for improved access to modern treatment modalities to enhance patient outcomes and reduce complications.*

Keywords: Kidney stone disease , Epidemiology of urolithiasis, Complications , Treatment

1. INTRODUCTION :

Kidney stones are a prevalent and costly condition. Recent epidemiological studies indicate that around 10% of the population in the United States will be affected by kidney stone disease during their lifetime, and this rate is on the rise.[1]

The treatment of renal stones has advanced with new technologies. Today, shock wave lithotripsy, percutaneous nephrolithotomy, and retrograde intrarenal surgery are the main treatments for upper urinary tract stones.The European Association of Urology updates its guidelines regularly. According to the 2012 guidelines, shock wave lithotripsy is the first choice for stones under 2 cm in the renal pelvis and upper or middle calyces. For larger stones, percutaneous nephrolithotomy or retrograde intrarenal surgery is preferred. In the lower pole, these methods are recommended even for stones smaller than 1.5 cm due to the limited effectiveness of shock wave lithotripsy.[2]

2. RESULTS

The study analyzed 46 cases, consisting of 20 men and 26 women, resulting in a female-to-male ratio of 1.3. The mean age of the cohort was 57.6 years, with ages ranging from 18 to 78 years, reflecting a broad demographic distribution.

The Casablanca region was the most represented geographic area, with 18 patients (39%). This was followed by the Settat region, contributing 10 cases (22%), and the El-Jadida region with 8 cases (17%). The remaining cases were distributed across less-represented regions. This highlights a potential geographic clustering of cases, particularly in urban and peri-urban areas such as Casablanca and Settat.

Nearly half of the patients (22, 48%) had no significant prior medical history, indicating that their condition could not be linked to pre-existing systemic diseases. Among the remaining 24 patients, 16 were obese (35%), 16 had hypertension (35%), 10 had type II diabetes (22%), and 6 had a history of high blood pressure (13%).

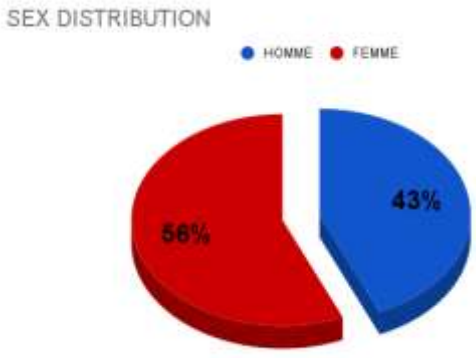

Figure 1:Sex Distribution of Patients

Regarding urological history, 18 patients (39%) had no prior urological conditions. However, 24 patients (52%) had a history of surgical intervention, primarily for lithiasis repair or ureteroscopy. Additionally, 2 patients were diagnosed with pyelo-ureteral junction syndrome, while 2 others had previously undergone contralateral nephrectomy.

The predominant reason for consultation was lower back pain, reported by 42 patients (90%). Of these, 34 patients (74%) experienced non-febrile back pain, which is often associated with obstructive uropathy or lithiasis without

infection. Meanwhile, 8 patients (17%) presented with febrile back pain, indicative of potential pyelonephritis or other infective complications.
In addition, 18 patients (39%) exhibited symptoms of lower urinary tract dysfunction, such as dysuria, urgency, or frequency, which may suggest underlying bladder or urethral involvement. Hematuria was reported by 10 patients (22%), a symptom often linked to urological malignancies, stones, or infections. Interestingly, 4 patients (9%) were asymptomatic, with their condition identified incidentally through routine imaging or other medical evaluations.

Five patients (11%) presented with acute obstructive renal failure, which was associated with acute obstructive pyelonephritis. Seven patients (15%) experienced acute obstructive renal failure without pyelonephritis, while six patients (13%) were diagnosed with isolated acute obstructive pyelonephritis, without accompanying renal failure.
Eight patients (17%) were already diagnosed with chronic kidney disease.

The glomerular filtration rate (GFR) varied between 5 and 94, with an average value of 59. This range indicates a significant variability in kidney function among the patients, with some experiencing severely reduced renal function while others had relatively preserved kidney filtration capacity.

The kidney stones were found on the left side in 23 patients (50%), on the right side in 13 patients (28%), and bilaterally in 10 patients (22%). This distribution highlights the prevalence of left-sided stones, with a smaller proportion of patients presenting with right-sided or bilateral stones, indicating variability in the location of the lithiasis among the affected individuals.

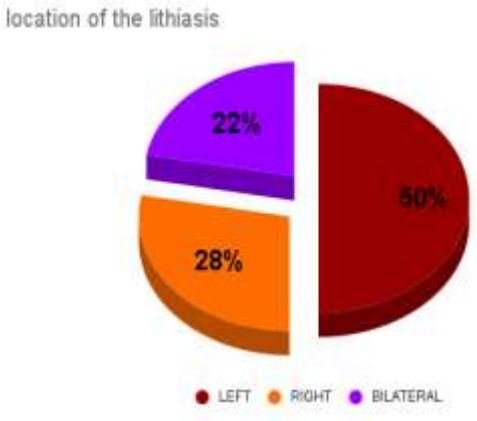

Figure 2:Distribution of Lithiasis Location

The number of kidney stones varied significantly among the patients. A total of 20 patients (43%) presented with a single stone, while 11 patients (24%) had two stones. Nine patients (19%) were found to have more than three stones, indicating a more complex form of lithiasis. The remaining six patients (13%) had multiple stones, with each patient having more than three stones in total. This distribution reflects the varying severity of lithiasis in the patient group, with the majority having either one or two stones, while a smaller percentage of patients experienced more extensive stone formation, which may suggest a higher risk of complications or a more chronic condition.

The average size of the largest axis of the kidney stones was 38 mm, with the sizes ranging from a minimum of 16 mm to a maximum of 78 mm. This wide variation in stone size suggests that the patients experienced different levels of stone severity. While some patients had relatively small stones, others had significantly larger ones, which could potentially lead to more severe symptoms or complications.

The average density of the kidney stones was 1034 HU (Hounsfield units), with values ranging from 350 HU to 2400 HU. This broad range reflects the variability in the physical properties of the stones. Ten patients had stones with a density of less than 500 HU, which generally indicates softer stones. Another 10 patients had stones with densities between 500 HU and 1000 HU, representing a moderate level of hardness. The majority of the patients, 26 in total, had stones with densities exceeding 1000 HU,

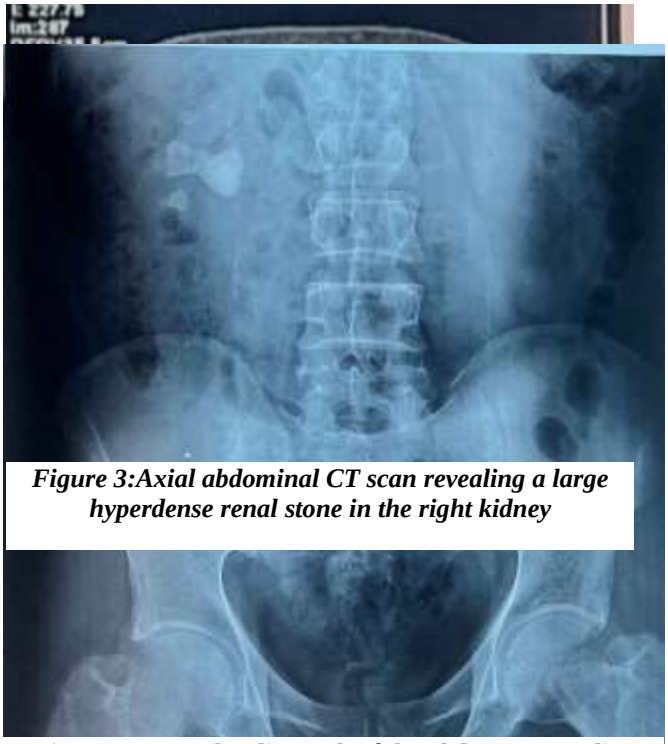

Figure 3:Axial abdominal CT scan revealing a large hyperdense renal stone in the right kidney

Figure 4:Frontal radiograph of the abdomen revealing radiopaque stones in the right kidney

suggesting a high level of hardness. The variation in density could imply differences in the composition and structure of the stones, which may impact the overall clinical course and outcomes for th0e patients.

The urine cytobacteriological examination was sterile in 36 patients, representing 78%. The culture was positive for *E. coli* in 3 patients (7%) and for *Klebsiella pneumoniae* in 7 patients (15%). This suggests that a majority of the patients did not have a urinary tract infection, while the remaining patients tested positive for common pathogens typically associated with urinary infections.

The etiological evaluation was normal in 25 patients (55%). Hyperuricemia was found in 11 patients (24%), while 8 patients (17%) had hypercalcemia. In 2 patients (5%), the workup was not conducted. This indicates that most patients did not have any identifiable underlying cause, while some had metabolic disturbances such as elevated uric acid and calcium levels, which are frequently linked to kidney stone formation.

Renal scintigraphy was conducted in 6 patients, and the results revealed that all of them had a non-functional kidney as a result of their lithiasis-related condition.

The treatment approach was tailored to the size, density, and location of the stones, as well as the patient's preferences. For unilateral kidney stones, 4 patients were treated medically with urine alkalinization following a sterile urine culture (ECBU), a non-invasive approach aimed at dissolving certain types of stones. Five patients underwent a single-step ureteroscopy, a minimally invasive procedure. Three patients required a two-step ureteroscopy, where the procedure is performed in stages, often due to the complexity or size of the stones.

For patients with more complicated cases, 5 underwent percutaneous nephrolithotomy (PCNL) via a single access point, a procedure where a small incision is made in the back to remove larger stones directly from the kidney. Two patients had PCNL performed via a double access, which may be necessary for particularly large or complex stones. Four patients had traditional surgical stone removal, a more invasive approach when other methods were not suitable. Laparoscopic surgery was performed on 11 patients, offering a less invasive option with smaller incisions and quicker recovery compared to open surgery. Finally, 2 patients underwent immediate nephrectomy, where the affected kidney was surgically removed, usually due to severe damage or dysfunction caused by the stone disease.

For bilateral kidney stones, the treatment approach was customized to address the complexity of each case. Two patients underwent a unilateral nephrectomy, where one kidney was surgically removed due to severe damage or dysfunction caused by the stone disease. Following the nephrectomy, a ureteroscopy was performed on the contralateral side to remove or treat stones in the remaining kidney.

Figure 5:Macroscopic view of multiple renal calculi of varying sizes, freshly extracted during a surgical procedure

Three patients were initially treated with percutaneous nephrolithotomy (PCNL) on one side to remove larger or more complex stones. After the first procedure, a two-step ureteroscopy was performed on the contralateral side to address stones on the opposite kidney, often due to the size or location of the stones that required multiple interventions.

In another two patients, laparoscopic surgery was performed on one side, a minimally invasive approach that uses small incisions and a camera for stone removal. After this procedure, a percutaneous nephrolithotomy was performed on the contralateral side to treat stones in the second kidney more effectively.

Two patients received bilateral ureteroscopy, where both kidneys were treated simultaneously through the urethra and bladder, removing stones or fragmenting them to ease their passage.

Finally, one patient had a percutaneous nephrolithotomy on one side, and the contralateral side was managed with medical treatment, such as urine alkalinization, reflecting a more conservative approach for the less complicated side.

A total of 35 patients required postoperative urinary diversion to ensure proper drainage and prevent complications after surgery. Among these, 23 patients were managed with a double J stent, Seven patients were diverted through a percutaneous nephrostomy,

In five cases, a combined approach was used, with both a double J stent and a nephrostomy tube inserted at the same time. This dual method is generally employed in more complex situations, where both internal and external drainage are necessary to manage the patient's condition and prevent complications such as infection or further obstruction. This combined approach ensures that the kidney remains adequately drained while the patient recovers from the procedure.

Postoperative outcomes were uneventful in 32 patients (69%), with no complications reported. However, complications were noted in the remaining cases. Urinary tract infections were diagnosed in 5 patients (11%), including one case that progressed to sepsis, necessitating intensive care unit admission.

Residual lithiasis was observed in 3 patients (7%), suggesting incomplete clearance of calculi and the potential need for additional interventions. Similarly, postoperative acute kidney injury occurred in 3 patients (7%), requiring close monitoring and, in some cases, supportive management.

Intraoperative hemorrhage was reported in 2 patients (4%), representing significant blood loss that may have required immediate corrective measures. Additionally, a surgical site infection was documented in 1 patient (2%), managed with appropriate wound care and antibiotic therapy.

These findings underscore the variability in postoperative outcomes, ranging from uncomplicated recoveries to serious complications requiring intensive medical or surgical management.

3. Discussion

Over the past decades, advancements in endoscopic treatment, extracorporeal shock wave lithotripsy (ESWL), and laparoscopy have virtually eliminated the need for open surgery in the management of renal stones, including bivalve nephrotomy. These minimally invasive approaches have replaced traditional methods due to their effectiveness, safety, and reduced post-operative complications, representing a significant shift in the treatment of renal lithiasis.[3]

Data on the nationwide incidence of symptomatic kidney stones in the United States are not available. However, a population-based study conducted in Minnesota reported a significant increase in the incidence of symptomatic kidney stones requiring treatment between 1984 and 2012. During this period, the incidence rose from 51 to 217 cases per 100,000 person-years in women and from 145 to 299 cases per 100,000 person-years in men.[4]

the female-to-male ratio was 0.71, indicating a higher proportion of male patients compared to females. The mean age of the participants was 47.6 years, with the youngest being 0.6 years (approximately 7 months old) and the oldest reaching 93 years. [5]

On the other hand, the study by Yattara reported a significantly lower female-to-male ratio of 0.36, suggesting a more pronounced male predominance in the patient population. The mean age of participants in this study was slightly younger, at 44.6 years.[6]

A history of lithiasis was the most frequently reported condition, observed in 36.3% of cases. This highlights the strong association between previous stone formation and the recurrence or progression of urological complications. Furthermore, 13 patients (14.3%) had JJ stents, indicating a pre-existing need for urinary drainage due to obstruction or other underlying conditions.[7]

Lower back pain is the primary symptom, and in most studies, it is predominantly characterized by renal colic and lower back pain. In our series, the frequency of pain was 90%, which is comparable to the findings reported by KAMBOU[8] at 97.27% and DEMBELE [9] at 83.47%. It is essential to conduct a detailed etiological investigation during the initial episodes of renal colic or lower back pain to identify small stones early. This approach facilitates timely diagnosis and effective treatment of lithiasis. However, the ability to perform such investigations often depends on the healthcare resources and medical infrastructure of the country.

In our study, hematuria was observed in 10 cases (22%). This rate is higher than the 13.90% reported by DEMBELE[9].

Micturition disorders were observed in 18 cases, representing 39% of our patients, and were often associated with other symptoms. This is notably lower than the rates reported by DEMBELE[9] and COULIBALY[10], who found micturition disorders in 87.2% and 77.4% of their patients, respectively. The differences in these figures could be attributed to variations in study populations, diagnostic methods, or the severity of the conditions being treated.

In our study, fever was observed as a sign of lithiasis in 8 cases, accounting for 17% of the patients. While this suggests that fever can sometimes serve as an indicator of kidney stones, it was less common in our series compared to the findings in Traore's study[11], where fever was noted in 23% of cases.

The lower incidence of fever in our study may be due to various factors, including differences in the severity of the cases, the presence of coexisting infections, or the types of stones involved. Additionally, it may also reflect differences in how fever is clinically observed or reported in different healthcare settings. In some cases, fever may not be prominent or may resolve before patients seek medical attention, particularly if the infection is not severe.

Therefore, while fever is a notable symptom of renal stones, its presence alone may not always indicate an active infection and should be interpreted in conjunction with other clinical findings.

In our series, 17% of patients showed signs of renal dysfunction. Marangella et al.[12] reported a similar frequency of 18% in their study. In contrast, other studies by DEMBLE [9], SOHEL[13], and ONGOIBA[14] found much lower rates, under 2%.

lithiasis disease led to a non-functioning kidney in 13% of cases, compared to 9.72% in the series by Z. Ouattara et al.[15] and 6.2% in Doukansi's[16] study.

The higher incidence of renal dysfunction observed in our study compared to these other series may be largely explained by delays in seeking initial medical consultation. Such delays often result in more advanced cases of kidney stone disease, which can increase the likelihood of complications like renal impairment. Early detection and treatment are crucial in preventing the progression of kidney damage in these patients.

In our cohort,the urine culture (ECBU) identified a urinary tract infection in 10 patients, accounting for 22%. When compared to other studies (Table I), our rate is the lowest. The most frequently isolated pathogen was *Escherichia coli*, which is consistent with the results reported by SOHEL[13] and ONGOIBA[14].

Tableau 1:Frequency of Urinary Tract Infection According to Different International Studies

Authors	year	country	Frequency
SOHEL*[13]*	1981	**Sénégal (DAKAR)**	**23,33%**
ONGOIBA*[14]*	1999	**MALI (BAMAKO**	**52,27%**
Our series	2024	**MAROC (CASABLANCA)**	**22%**

In our study, there was no significant difference between the affected sides (13 on the right, 23 on the left, and 10 with bilateral involvement). This result is consistent with Pérou A. [17], who reported a frequency of 37% on the right and 35.6% on the left.

In our study, stone sizes varied from 16 to 78 mm, a result similar to that reported by Cissé B.[18], where the stone size ranged from 5 to 45mm.

Urinary lithiasis is a common and recurrent condition, mainly affecting young adults and posing a public health challenge with significant costs.

Thanks to technological advancements, treatments have become more reliable, less invasive, and highly effective, simplifying disease management. Open surgery is now rarely used, accounting for only 5 to 10% of cases, while 90% of urinary stones are treated with modern techniques [19].

However, our surgical approach is constrained by limited resources and the high cost of advanced treatments like endourology, which could reduce morbidity and hospital stays. A lack of training in these techniques also hinders their use.

Assimos et al. compared open nephrolithotomy and percutaneous nephrolithotomy (PNL), with or without additional extracorporeal shock wave lithotripsy (ESWL). They found that a high stone volume led to more procedures, increased hospitalizations, and higher overall treatment costs for patients undergoing PNL.[20]

In terms of stone-free outcomes, PNL remains less effective than open surgery, especially for complex staghorn calculi. Reported success rates in the literature range from 49% to 90% for PNL, whereas open surgery achieves rates between 82.1% and 100%.[20]

The semi-rigid ureteroscope was the most commonly used (47.2%), followed by the flexible ureteroscope (16.5%). In 26.4% of cases, a combination of ureteroscopes was used.[7]

The location and large size of the stone were the main reasons for combining ureteroscopic techniques. The combination of flexible and rigid or semi-rigid ureteroscopy is often necessary to thoroughly explore the calyces or properly position the stone for intracorporeal lithotripsy.

Open surgery for the treatment of renal and ureteral stones has largely been replaced by PNL, endoscopy, and ESWL. However, it remains indicated in cases where other techniques fail or for the management of complex, branched stones, especially when associated with anatomical anomalies requiring urinary tract reconstruction.[21]

El Alaoui et al. reported an average postoperative hospital stay of 10 days. Immediate and early postoperative outcomes were uncomplicated in 36 patients. However, 6 patients (11.3%) required a blood transfusion, 2 developed severe postoperative sepsis, 5 cases (9.4%) experienced wound infections, and 4 cases (7.5%) had urinary fistulas, which were subsequently managed with endoscopic drainage.[20]

Stone recurrence is the most significant challenge following surgical treatment for renal lithiasis. In recent years, its incidence after open surgery has been extensively analyzed, though reported rates vary across studies.

WILLIAMS[22] conducted a five-year follow-up of a large cohort of operated patients, reporting a recurrence rate of 8% after pyelotomy and 17% after nephrolithotomy. More recently, SLEIGHT and WICKHAM[23] observed a 14.7% recurrence rate following pyelonephrolithotomy with arterial clamping and regional hypothermia.

In our study, the overall recurrence rate, regardless of the treatment approach, was 7%.

4. Conclusion

Renal stone disease is a common condition with significant clinical and therapeutic challenges. Our study highlights its high prevalence and the predominance of lower back pain as the main symptom.

Minimally invasive techniques, such as ureteroscopy and percutaneous nephrolithotomy, have improved patient outcomes by reducing complications and hospital stays. However, in resource-limited settings, open surgery remains necessary due to limited access to advanced procedures.

Despite effective treatment, complications like infections, residual stones, and renal impairment persist, with a recurrence rate of 7%. Enhancing early diagnosis and expanding access to modern treatments are key to improving patient care and reducing recurrence.

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