Management of urolithiasis in patients with chronic kidney disease

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Abstract

Context: Management of urolithiasis in patients with chronic kidney disease.

Aims: To ascertain the best method surgical or noninvasive.

Settings and Design: This was a single-institute study.

Subjects and Methods: A total of 50 patients of CKD with urolithiasis were enrolled in this comparative study. Clinical evaluation, biochemical evaluation, and radiological imaging were done. The management strategies were individualized to patient need. Following procedure, imaging and biochemical assessment were done to assess the stone clearance and improvement in the renal parameters. Intraoperative and postoperative complications are also noted. The patients were followed up to 6 months.

Statistical Analysis Used: Statistical Package for the Social Sciences version 21.0 software was used for statistical analysis.

Results: The mean age of the patients was 55.22 ± 10.76 years (range 28–76). Majority were male (76%) and had unilateral involvement. The mean preoperative hemoglobin (Hb), urea, creatinine, and total leukocyte count (TLC) were 9.49 ± 0.84 g%, 71.13 ± 24.09 mg/dl, 4.71 ± 2.45 mg/dl, and 8.67 ± 1.81 thousands/cumm, respectively. Percutaneous nephrolithotomy (PCNL) and ureteroscopic lithotripsy (URSL) were the most common procedures performed in 23 (46%) and 12 (24%) patients, respectively. In 5 (10%) patients, PCNL with URSL was used. The clearance rate for different techniques ranged from 40% (PCNL with URSL) to 91.7% (URSL alone). The overall clearance rate was 78.3%. Fever (40%) and deranged renal function test requiring hemodialysis (16%) were the most common postoperative complications. Postoperatively, a significant decline in the mean Hb, serum (S.) urea, and S. creatinine was observed. The mean TLC levels showed a significant increase. During follow-up, S. creatinine levels showed consistent decline. Auxiliary procedures were needed in six (12%) cases. There were two (4%) mortalities.

Conclusions: The management of urolithiasis among CKD patients requires individualized approaches. The selection of appropriate strategy results in good outcome and minimum complications.

Keywords: Chronic kidney disease, percutaneous nephrolithotomy, renal functions, ureteroscopic lithotripsy, urolithiasis

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INTRODUCTION

Urolithiasis is known to affect renal functions and is a recognized risk factor for chronic kidney disease (CKD). In view of associated conditions such as hypertension, diabetes, and other cardiovascular diseases, the management of these stones is a challenging task for surgeons. Restoration of normalized renal functions is the desired outcome of different management strategies with a focus on minimal complications and effective stone clearance. Extracorporeal shockwave lithotripsy (ESWL) and percutaneous nephrolithotomy (PCNL) either alone or their combination have been reported to be the one of the most commonly used and successful treatment modalities for urolithiasis; however, the success rates are mixed in nature. However, the selection of appropriate approach depends on the size, number, type, shape, and laterality of stone, as well as on individual patient characteristics such as age, comorbidity profile, and stage of CKD. This study was conducted with the aim of assessing the available treatment modalities (surgical and nonsurgical) with respect to clearance rates, complication rates, and change in renal function. In the present study, we describe our experience of the management of urolithiasis in patients of CKD adopting a patient-specific approach.

SUBJECTS AND METHODS

This comparative study was done at the Department of Urology, Dr. D. Y. Patil Medical College, Pune, from August 2016 to December 2018. A total of 50 patients were enrolled in the study after obtaining the institutional ethical clearance and getting informed consent from the patients. All the CKD patients with a radiologically confirmed diagnosis of renal stone aged between 10 and 75 years were included in the study. Patients unfit for surgery were excluded. The management strategies under consideration included PCNL, ureteroscopic lithotripsy (URSL), retrograde intrarenal renoscopy, laparoscopic/open pyelolithotomy/ureterolithotomy, extracorporeal shock wave lithotripsy (ESWL), and cystolithotripsy. The selection of appropriate approach was done after a thorough clinical, biochemical, and radiological (X-ray/ultrasonography [USG]/computed tomography [CT]) evaluation of the patient.

Patients with an obstructed pelvicalyceal system underwent double-J (DJ /JJ) stenting or percutaneous nephrostomy if JJ stenting failed.

All the patients operated were given appropriate anesthesia for the procedure.

All patients were given broad-spectrum antibiotic (injection piperacillin/tazobactam 2.25 g BD for 3 days).

On postoperative day 1, hemoglobin (Hb) and renal function test were done along with the X-ray of kidney, ureter, and bladder (KUB) and USG of the abdomen.

DJ stent removal was done after 3 weeks.

Follow-up visits were scheduled at 3 and 6 months, and at each visit, serum (S.) creatinine value was evaluated.

Complete clearance was considered when the postoperative X-ray KUB film showed no residual stone or insignificant stone fragments <4 mm on USG and CT scan wherever necessary and only where the patient was affordable.

Data were analyzed using Statistical Package for the Social Sciences, version 19.0 (SPSS, Inc., Chicago, Ill., USA). Chi-square test, paired t-test, and Wilcoxon signed-rank tests were used to analyze the data. P < 0.05 was considered statistically significant.

RESULTS

The patients’ age ranged from 28 to 75 years, the mean age of the patients was 55.22 ± 10.76 years, and majority of the patients (70%) were above 50 years of age. Majority were male (76%) and had unilateral involvement (74%). The mean preoperative S. Hb, urea, creatinine, and total leukocyte count (TLC) were 9.49 ± 0.84 g%, 71.13 ± 24.09 mg/dl, 4.71 ± 2.45 mg/dl, and 8.67 ± 1.81 thousands/cumm, respectively. PCNL and URSL were the most common procedures used in 23 (46%) and 12 (24%) patients, respectively. In addition, in 5 (10%) patients, PCNL with URSL was used. There were 2 (4%) patients in whom laparoscopic ureterolithotomy was performed, whereas in one case each, URSL with cystolithotripsy, cystolithotripsy, PCNL with laparoscopic ureterolithotomy, and cystolithotomy with ureterolithotomy–open was performed [Table 1].

The clearance rate for different techniques ranged from 40% (PCNL with URSL) to 91.7% (URSL alone). ESWL alone had a clearance rate of 75% while PCNL alone had a clearance rate of 78.3%. The clearance rate in other modalities was 83.3%. The overall stone clearance rate was 78.3%. Statistically, there was no significant association between the management strategy used and clearance rate (P = 0.228) [Table 2].

Fever (40%) and deranged renal function test requiring hemodialysis (16%) were the most common postoperative
complications. Bleeding (12%) and sepsis (6%) were other relatively less common postoperative complications. The mean postoperative Hb, serum urea, creatinine, and TLC levels were 8.75 ± 0.85 g%, 56.76 ± 21.46 mg/dl, 3.78 ± 1.51 mg/dl, and 9.74 ± 2.64 thousands/cumm, respectively. Postoperatively, a significant decline in the mean Hb (7.8%), S. urea (20.2%), and S. creatinine (19.75%) was observed. The mean TLC levels showed a significant increase (12.27%). During follow-up, S. creatinine levels showed a consistent decline at 3 (32.91%) and 6 months (39.70%), respectively (P < 0.001). Auxiliary procedures were needed in 6 (12%) cases. Miniperc (n = 4, 8%) was the most common auxiliary procedure, whereas in 1 (2%) case each, URSL and ESWL were needed. There were 2 (4%) mortalities, while 3 (6%) patients were lost to follow-up [Table 3].

DISCUSSION

The present study showed promising outcomes with

Table 1: Demographic, clinical, and biochemical profile of chronic kidney disease patients with urolithiasis and proposed management strategies

| Characteristic                      | Statistic       |
|------------------------------------|-----------------|
| Mean age (years)±SD (range)        | 55.22±10.17 (28-75) |
| Gender, n (%)                      |                 |
| Male                               | 38 (76.0)       |
| Female                             | 12 (24.0)       |
| Mean Hb±SD (gm%)                   | 9.49±0.84       |
| Mean serum urea±SD (mg/dl)         | 71.13±24.09     |
| Mean serum creatinine±SD (mg/dl)   | 4.71±2.45       |
| Mean TLC±SD (thousands/cumm)       | 8.67±1.81       |
| Laterality, n (%)                  |                 |
| U/L                                | 37 (74.0)       |
| B/L                                | 13 (26.0)       |
| Management strategy                |                 |
| PCNL (U/L, BL)                     | 23 (18, 5)      |
| URSI (U/L, BL)                     | 12 (5, 7)       |
| ESWL                               | 4               |
| PCNL with URSI                     | 5               |
| Laparoscopic ureterolithotomy       | 2               |
| URSI with cystolithotripsy          | 1               |
| Cystolithotripsy (B/L)              | 1               |
| PCNL with laparoscopic ureterolithotomy | 1            |
| Cystolithotripsy with ureterolithotomy open | 1            |

Table 2: Association between management strategy and complete clearance of stones

| Management strategy | Total number of cases | Number of cases with complete clearance | Rate of complete clearance (%) |
|---------------------|-----------------------|----------------------------------------|-------------------------------|
| PCNL                | 23                    | 18                                     | 78.3                          |
| URSI                | 12                    | 11                                     | 91.7                          |
| PCNL with URSI      | 5                     | 2                                      | 40.0                          |
| ESWL                | 4                     | 3                                      | 75.0                          |
| Others              | 6                     | 5                                      | 83.3                          |
| Total               | 50                    | 39                                     | 78.0                          |

χ² = 5.63, df = 4, P = 0.228. PCNL: Percutaneous nephrolithotomy, U/L: Unilateral, B/L: Bilateral

In the present study, there were 2 (4%) deaths. The cause of death was sepsis. Techniques such as PCNL,ESWL,URSL,and laparoscopic surgery in place of open surgery are known to minimize the post operative morbidity and mortality.[13-15] In the present study, although the open surgery was done in only one case, yet it was the case that contributed to one of the two mortalities. In fact, open surgery should be avoided in CKD patients owing to higher rates of reported morbidity and mortality due to risk of both anesthetic and surgical complications.[13-15]
In our study, for 11 cases of incomplete clearance, auxiliary procedures done were miniperc in 4 (8%) cases, URSL in 1 (2%), and ESWL in 1 (2%), and five cases were not resorted to further treatment as they were small and were in the lower calyx. Compared to the present study, Bhadauria et al. reported three insignificant residual calculi and seven patients who required ESWL as auxiliary procedure. Kukreja et al. also reported auxiliary ESWL in six cases in their study.

In the present study, the improvement in renal functions was observed both in immediate postoperative and up to 6-month follow-up. Urolithiasis is known to impair the renal functions, and its resolution is known to result in improvement in renal function as observed in the previous studies too.

**CONCLUSION**

The findings of the present study thus showed that noninvasive and minimally invasive techniques were successful in managing most of the renal stone cases with CKD. The resolution of these stones was helpful in restoring the functional state too. We recommend the use of individualized, patient-specific management strategies in view of individual patient needs.

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**Conflicts of interest**

There are no conflicts of interest.

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