Original Article

Management of urolithiasis in patients with chronic kidney disease

Vikram P. Satav, Sonu Sharma, Rohit Kapoor, Vilas P. Sabale, Avreen Singh Shah, Ashwani Kandari

Department of Urology and Renal Transplantation and Robotic Surgery, Dr. D. Y. Patil Medical College and Hospital, Pune, Mahrashtra, India

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

Address for correspondence: Dr. Sonu Sharma, Department of Urology, Dr. D. Y. Patil Medical College and Hospital, Pune - 411 018, Mahrashtra, India.
E-mail: sharmasonubt@yahoo.com

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INTRODUCTION

Urolithiasis is known to affect renal functions and is a recognized risk factor for chronic kidney disease (CKD).[1-3] In view of associated conditions such as hypertension, diabetes, and other cardiovascular diseases,[4,5] 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.[6-10] 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 high stone clearance rates (78%). Although the clearance rate was lower (40%) in patients where combined PCNL and URSL was done and high (91.7%) among those in whom URSL was done, the difference was not statistically significant. Kukreja *et al.*[11] reported a relatively higher success rate (85.7%) in their study using multiple treatment modalities as in the present study. In the present study, the success rate for PCNL was 78.3% which is comparable to that reported by Akman *et al.*,[6] who in their study reported a success rate of 80.2%, and Etemadian *et al.*,[7] who reported it to be 83.3%, and slightly higher than that reported by Ekrem *et al.*,[12] who reported it to be 70.5%. The use of treatment modalities, based on stone as well as patient characteristics in the present study, and the selection of multiple modalities in the present study show that the customized management strategies have high success rate.

The complications we encountered in the patients in our study were fever in 20 (40%) cases, deranged renal function test requiring hemodialysis in 8 (16%) cases, and bleeding in 6 (12%) cases of which three required transfusion and sepsis in 3 (6%) cases. Akman *et al.* analyzed the data of 177 patients where 17 cases required blood transfusion, five patients had urosepsis, and six patients had fever.[6] Etemadian *et al.* reported ten patients (16.6%) with fever and five patients who required blood transfusion,[7] while Ekrem *et al.* reported two patients with bleeding and two patients with fever.[12] Although, in the present study, the incidence of fever was slightly higher as compared to previous studies, in most of the patients, the fever was of low grade (<100°F) and was easily controlled.

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]

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)
URSL (U/L, BL)	12 (5, 7)
ESWL	4
PCNL with URSL	5
Laparoscopic ureterolithotomy	2
URSL with cystolithotripsy	1
Cystolithotripsy (B/L)	1
PCNL with laparoscopic ureterolithotomy	1
Cystolithotomy with ureterolithotomy open	1

SD: Standard deviation, Hb: Hemoglobin, TLC: Total leukocyte count, URSL: Ureteroscopic lithotripsy, ESWL: Extracorporeal shock wave lithotripsy, PCNL: Percutaneous nephrolithotomy, U/L: Unilateral, B/L: Bilateral

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
URSL	12	11	91.7
PCNL with URSL	5	2	40.0
ESWL	4	3	75.0
Others	6	5	83.3
Total	50	39	78.0

$\chi^2=5.63$, df=4, $P=0.228$. PCNL: Percutaneous nephrolithotomy, URSL: Ureteroscopic lithotripsy, ESWL: Extracorporeal shock wave lithotripsy

Table 3: Postoperative complications, biochemical, follow-up profile, and outcome (*n*=50)

Characteristic	Statistic
Postoperative complications, *n* (%)	
Fever	20 (40.0)
Hemodialysis	8 (16.0)
Bleeding	6 (12.0)
Sepsis	3 (6.0)
Mean postoperative Hb±SD (gm%)	8.75±0.85*
Mean postoperative TLC±SD (thousands/cumm)	9.74±2.64
Renal functions (mg/dl)	
Immediate postoperative, mean serum urea±SD	56.76±21.46*
Immediate postoperative, mean serum creatinine±SD	3.78±1.51*
Mean serum creatinine±SD at 3 months FU (*n*=45)	3.16±1.11*
Mean serum creatinine±SD at 6 months FU (*n*=45)	2.85±0.82*
Outcome, *n* (%)	
Survived	45 (90)
Death	2 (4)
Loss to FU	3 (6)
Auxiliary procedure need, *n* (%)	6 (12)
Miniperc	4
ESWL	1
ESWL	1

*Significant as compared to baseline values paired *t*-test. SD: Standard deviation, Hb: Hemoglobin, TLC: Total leukocyte count, FU: Follow-up, URSL: Ureteroscopic lithotripsy, ESWL: Extracorporeal shock wave lithotripsy

In our study, for 11 cases of incomplete clearance, auxiliary procedures done were miniperc in 4 (8%) cases, URSL in 1 (2%), 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.[16] Kukreja *et al*. also reported auxiliary ESWL in six cases in their study.[11]

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.[3,6-14]

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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