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Original Research Article

The effect of percutaneous nephrolithotomy in patients with chronic kidney disease in northeast India population

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ABSTRACT

Background: Renal stone disease is a recognized precursor for renal deterioration, if untreated, it can lead to renal failure. With advances in the PCNL technique, it's effect on patients with established renal insufficiency remains under reported. So, we aimed to evaluate the efficacy as well as safety of PCNL in chronic kidney disease patients.
Methods: This retrospective cohort study included patients admitted to our hospital from January 2016 to December 2018, which were diagnosed with urolithiasis and chronic kidney disease and treated by PCNL. Patients with GFR <60 ml/min/1.73 m^2 in the non-obstructed renal stone disease who underwent PCNL were included. We studied the change in renal function, complete stone free rate (SFR), complications, stone composition, operative time and hospital stay.
Results: The study comprised 50 patients (M/F-32/18) Of CKD who underwent PCNL. Mean operative time was 90.50±12.57minutes in group 1 and 98.00±12.35 minutes in group 2. One or more complications were noted in 12 patients (24%) after PCNL. At a mean follow-up of 18 months, renal function stage had improved in 24 patients (48%) and it was maintained in 13 (26%). Worsening of CKD with an increase in disease stage was noted in 13 patients (26%). Association between hypertension, diabetes, and postoperative deterioration in kidney function wasn't significant statistically (p=0.9). The stone-free rate at postoperative month 3 was 76%.
Conclusions: PCNL has a favourable outcome in patients with chronic kidney disease stage III/IV, with a good calculus clearance rate and improved kidney function.

Keywords: CKD, Endourology, PCNL

INTRODUCTION

Renal stone disease is a recognized precursor for renal deterioration. If untreated, it can lead to renal failure.[1] The prevalence of nephrolithiasis in patients with concomitant chronic kidney disease (CKD) is estimated to be 17.5%.[2] Management of such patients need multidisciplinary approach because they are at high risk of anaesthetic as well as post-procedure complications.[1]

The etiology of chronic kidney disease has been multifactorial and includes renal obstruction, recurrent urinary tract infections, frequent surgical interventions and coexisting medical disease.[2-4] Association of various comorbid conditions like diabetes, hypertension and anemia along with chronic kidney disease may increase the operative risk, the incidence of postoperative complications and the success rate.

In addition to achieving good stone clearance, surgical interventions employed in the treatment of stone disease must try and preserve maximal renal function. Management of nephrolithiasis in patients with CKD is, therefore, a difficult challenge for the endourologist as well as nephrologists and calls for careful consideration of the risks against the benefits.

Over the years, technical and instrumental advances have been made in PCNL to reduce morbidity and improve effectiveness. With advances and increased use of PCNL, the effect on patients with established renal insufficiency remains under reported. So, we aimed to evaluate the efficacy as well as safety of PCNL in chronic kidney disease patients.

METHODS

This retrospective cohort study included patients admitted to Dispur hospital, Guwahati from January 2016 to December 2018, which were diagnosed with urolithiasis and chronic kidney disease and treated by PCNL. The Convenience sampling method was used.

Inclusion criteria

Patients with GFR <60 ml/min/1.73 m^2 in non-obstructed renal stone disease who underwent PCNL were included.

Exclusion criteria

Patients <18 years of age and CKD stage 5 patients were excluded.

We studied the change in renal function, complete stone free rate (SFR) and complications which were graded using the modified Clavien system, stone composition, operative time and hospital stay.

Detail history taking and clinical examination were done in all cases. Patients were advised following tests. CBC, renal function test, urine routine and culture, x ray KUB, USG KUB, NCCT KUB, and renal scan.

Following induction of anesthesia, a 6-Fr ureteral catheter (open-ended) was placed to the stone side in lithotomy position via cystoscopy. Patient was turned to prone position and radiocontrast medium injected through ureteric catheter under fluoroscopy guidance. Puncture and dilatation of the tract was done as per Triangulation technique using Amplatz dilators. Tract was dilated up to 26 Fr and procedure performed with a 20 Fr Dresden nephroscope (Richard Wolf, Germany), pneumatic lithotripter (swiss lithoclast and Nidhi lithoclast), and grasping forceps. All fragments that were accessible by a rigid nephroscope were removed with a grasping forceps.

As per our institutional protocol, at the end of procedure, an 18-French nephrostomy tube and balloon was inflated with 5 ml of contrast material and 6 French DJ stent were placed in all patients. Nephrostomy was declamped after 6-8 hours and removed after 48-72 hours depending upon the appearance of urine. DJ stent was removed at 1 month depending upon stone clearance. Operative time was defined as time elapsed from induction of anesthesia till termination of procedure. Number of punctures, size of tract, and number of sessions were recorded for each patient.

Patients were followed up with urinalysis, serum creatinine and ultrasound KUB. Thereafter patients were followed every 3 monthly with urinalysis, serum creatinine and ultrasound KUB every 3 months, respectively. Preoperative CKD stage and eGFR were compared with measurements made at 18 months follow up visit. Patients were divided into two groups. Group 1- improved and group 2- stable or worsened disease since the final follow up visit. Appropriate descriptive and inferential statistics were used for data analysis.

RESULTS

In our study, patients with preoperative GFR less than 60 ml per minute/1.73 m^2, followed up for a minimum of 1 year were included in analysis.

Baseline characteristics

Finally, the study comprised 50 patients who underwent PCNL, including 32 men and 18 women. Mean SD age was 42.55 years. In groups 1 and 2 the mean body weight index was 28.4±5.1 and 29.0±6.1 kg/m^2, respectively. Nearly 30% (n=15) of patients had concomitant urinary infection at the time of surgery. Thirty two patients had bilateral renal stones while remaining 18 patients had unilateral renal stones. Mean stone burden was 352.38± 140.10 mm^2. Renal pelvis followed by lower calyx was the most common location. Mean follow-up was 18 months. Comorbidities associated with CKD included diabetes mellitus in 08 patients, hypertension in 40 patients. Preoperative dialysis was done in 05 cases. A total of 34 patients (68%) were treated with single-access PCNL and the remaining 16 (32%) underwent multitract PCNL. Multiple PCNL sessions were performed in 12 cases (24%). supracostal puncture was done in 06 patients. operative time was 90.50±12.57 minutes in group 1 and 98.00±12.35 minutes in group 2. Mean time to nephrostomy tube removal was 2.14±0.98 days and mean hospitalization was 4±0.86 days.

Outcome measures

One or more complications were noted in 12 patients (24%) after PCNL. Blood transfusions were required in 07 cases (14%). All patients were successfully treated with conservative measures. A Double-J® stent was placed in all patients which was removed after 1 month. Urosepsis was detected in 02 patients (4%), who were successfully treated with intravenous antibiotics. Acute renal failure developed in 3 patients (1.7%) but hemodialysis was not required. Neither hydrothorax nor hemothorax developed in any patient.

Mean eGFR during the preoperative period and at long-term follow-up (18 months) was, 42.50±14.43/ 48.62±14.39 ml per minute/1.73 m^2 in group I and 38.31±12.92/35.31±12.43 ml per minute/1.73 m^2 in group II, respectively. At a mean follow-up of 18 months renal function stage had improved in 24 patients (48%) and it was maintained in 13 (26%). Worse CKD with an increase in disease stage was noted in 13 patients (26%).

Table 1: Comparison of group I (improved function) and group II (stable or decreased renal function) in our study.

Parameters		Group I (24)	Group II (26)	P value
Gender	Male (32)	14	18	0.423
	Female (18)	10	08	
Side	Right	18	15	0.197
	Left	06	11	
Access number	Single (34)	18	16	0.308
	Multiple (16)	6	10	
Mean preoperative GFR (ml/minute/1.73 m^2)		42.50±14.43	38.31±12.92	0.284
GFR at 18 months follow up (ml/minute/1.73 m^2)		48.62±14.39	35.31±12.43	0.001
Comorbidities	Diabetes	04	04	0.990
	Hypertension	19	21	
	Both	01	01	
Staghorn stones		09	13	
Operative time (minutes)		90.50±12.57	98.00±12.35	0.039
Complications		05 (14.7%)	07 (37.5%)	0.890
Recurrent UTI		03 (12.5%)	03 (11.5%)	0.917

Among these, 13 patients including 10 with stage 4 and 03 with stage 3 CKD, eventually showed end stage renal failure at a mean follow-up of 18 months. 05 of these patients began a routine hemodialysis program and 1 underwent renal transplantation. Mean complication rate was 14.7% in group I and 37.5% in group II. These were distributed as following: fever in 6 patients, urine leak in 2 patients which improved with conservative management, sepsis requiring ICU admission in 4 patients.

On chi square analysis correlations between diabetes, hypertension, obesity and worsening of renal function weren't statistically significant (p value=0.99). On applying t test, there was statistically significant difference in operative time in two groups. The stone-free rate at postoperative month 3 was 76%.

DISCUSSION

Urinary tract calculi cause renal damage because of resultant obstruction, infection, and frequent surgical interventions.[6] The renal damage increases much more if there is associated conditions like hypertension, diabetes, and obesity.[5.] If one of these conditions is expected in these RF patient's removal of renal stone is critical for renal functions. The goal of surgical treatment is to relieve the obstruction and control infection with minimum renal damage.

Kurien et al in 2009 studied Ninety-one chronic kidney patients who underwent PCNL The estimated glomerular filtration rate (eGFR) pre-PCNL (post drainage), peak eGFR on follow-up, and eGFR at last follow-up were recorded. The CKD stage pre-PCNL was compared with the CKD stage at last follow-up. Complete clearance, auxiliary procedure, and complication rates were 83.7%, 2.5%, and 17.1%, respectively. The mean eGFR pre-PCNL and peak eGFR at follow-up were 32.1±12.8 ml/min/1.73m^2 and 43.3±18.8 ml/minute/1.73 m^2, respectively (p<0.0001). At a mean follow-up of 329±540 days, deterioration with upmigration of CKD stage was seen in 12 patients (13.2%). Eight patients (8.8%) required RRT in the form of either maintenance hemodialysis or renal transplantation. In our study mean eGFR during the preoperative period and at long-term follow-up (18 months) was, 57.98 and 58.14 ml per minute/1.73 m^2, respectively.[7]

Kukreja et al in 2003 presented the data on the progression of renal function in CKD patients with renal stones after PCNL in 84 patients. Serum creatinine rather than eGFR was used to measure renal function.[8] Over a mean follow-up of 2.2 years (range 6 months-6 years), 33 patients (39.3%) showed improvement, 24 (28.6%) showed stabilization, and 27 (32.1%) showed deterioration in their renal function. The factors predicting deterioration in renal function were proteinuria (>300 mg/day), atrophic cortex (<5 mm), recurrent urinary tract infection, stone bulk (>1500 mm^2), and pediatric age group.[4] In Our study we have found significantly improved the functional outcomes of 68% compared with the 67.9% in their study period of 10 years from 1991. Patients with decreased renal function on follow up post PCNL had associated co morbidities and 13 out of 16 patients had staghorn stones.

Majority of the patients in our study were in CKD stages 2 and 3 (45 of the 50 patients). Majority of the patients benefited after PCNL with improved or stabilized renal function. Improved renal function after PCNL was seen in 48 % of the patients. Complete stone removal and infection control are the key factors responsible for improvement in GFR post PCNL.

Complication and blood transfusion rates were comparable to those published in the literature. In our

study blood transfusions were required in 07 cases (14%) and 01 patient required angioembolisation. Urosepsis was detected in 1 patient (2%), who was successfully treated with intravenous broad-spectrum antibiotics.

In study by Kurien et al postoperative bleeding complication requiring blood transfusions was seen in seven (5.9%) and two (1.7%) of the renal units subsequently required super selective angioembolization.[8]

Akmen et al noted post-operative complications in 27 patients (15.2%) after PCNL. Blood transfusions were required in 17 cases (9.6%). All patients were successfully treated with conservative measures. A Double-J® stent was placed in 1 patient secondary to pelvicalyceal system perforation and in 4 (2.2%) due to persistent urine leakage after nephrostomy tube removal. Urosepsis was detected in 5 patients (2.8%), who were successfully treated with intravenous broad-spectrum antibiotics.[9]

A study by Akdeniz et al observed Fever in two patients (11.8%) during the postoperative period. The mean decrease in hemoglobin level was 1.6 gm/dl. Two patients (11.8%) required blood transfusions in the perioperative period.[10]

Postoperative complications mainly infective and bleeding complications significantly affect the long-term outcome. Prior nephrostomy drainage, reduced pelvic pressures, reduction in the track size, staging of PCNL and preoperative administration of broad spectrum antibiotics are essential as it improves the renal function, reduces existing infection, and create a mature track that decreases bleeding episodes during PCNL.

The major limitation of this study is that it's a retrospective study andl term follow up is needed.

CONCLUSION

PCNL has a favorable outcome in patients with chronic kidney disease stage II/III, with a good calculus clearance rate and improved kidney function.

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