Outcome of Percutaneous Nephrolithotomy in Chronic Kidney Disease Patients - a prospective study

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Abstract-

INTRODUCTION- Chronic kidney disease (CKD) is a common public health disorder that is defined as sustained kidney injury of more than 3 months resulting in a GFR of less than 60 mL/ min/1.73 m2 by Kidney Disease Outcomes Quality Initiative (K/DOQI) Advisory Board. Patient with CKD represent 0.8%-17.5% of those presenting with urinary stone disease, these patients often have various associated comorbidities. The likelihood of these comorbid conditions may increase the operative risk. Pcnl (percutaneous nephrolithotomy) is standard surgical procedure in removal of these stones.

Hence this prospective study was done to evaluate outcomes of renal function in patients with Renal stone in CKD who underwent PCNL and to determine the factors affecting outcome.

AIM- To evaluate the functional outcome of PCNL of renal calculi in CKD patients, To analyse the improvement in renal function after intervention and factors affecting outcome.

MATERIALS AND METHODS- 30 patients who fulfilled inclusion criteria were included in the study.

RESULTS- Overall renal function improvement was seen in 19 (63.33%) patients, while in 11 (36.66%) patients it deteriorated.

CONCLUSION- PCNL can be carried out with acceptable complication rates in patients with CKD.

INTRODUCTION

Chronic kidney disease (CKD) is a common public health disorder that is defined as sustained kidney injury of more than 3 months resulting in a GFR of less than 60 mL/ min/1.73 m2 by Kidney Disease Outcomes Quality Initiative (K/DOQI) Advisory Board(1). In India, it has been recently estimated that the age-adjusted incidence rate of ESRD is 229/million population, and >100,000 new patients enter renal replacement programs annually(2,3). Patient with CKD represent 0.8%-17.5% of those presenting with urinary stone disease(4,5). The incidence of developing end stage renal disease (ESRD) in patients with renal calculi is 0.2-3.2%(6). The etiology of renal insufficiency in patients with nephrolithiasis is multifactorial and includes renal obstruction, recurrent urinary tract infections, frequent surgical interventions and coexisting medical disease(4, 5, 7). Patients with chronic kidney disease frequently have various medical comorbidities, such as diabetes, hypertension, anemia and bleeding disorders.

The likelihood of comorbid conditions may increase the operative risk, the incidence of postoperative complications, and negatively impact the success rate. In modern era PCNL (percutaneous nephrolithotomy) remains a gold standard procedure in management of patients with CKD (Chronic kidney disease) and renal stone disease. Though PCNL has high stone free rates, it also has significant potential complications like bleeding requiring blood transfusion, pleural injury, visceral injury and sepsis. Outcomes and safety of PCNL is well established in patients with normal renal function, there is limited data on outcomes of Patients with CKD undergoing PCNL. Hence this prospective study was done to evaluate outcomes of renal function in patients with Renal stone in CKD who underwent PCNL and to determine the factors affecting outcome.

AIMS AND OBJECTIVES

1, To evaluate the functional outcome of PCNL of renal calculi in CKD patients.
2, To analyse the improvement in renal function after intervention and factors affecting outcome.

MATERIALS AND METHODS

This was a prospective study carried in department of urology at PGIMS, Rohtak. The study included 30 patients who had CKD with renal stone disease and underwent PCNL.

Inclusion criteria –

1. Patients with Renal stone disease with CKD (eGFR<60/ s.creatinine>2)
2. Good Performance Status [Eastern Cooperative Oncology Group (ECOG): 0–2)

Exclusion criteria –

1.Patients with congenital anomalies of Urinary tract obstruction.
2.Poor Performance Status [Eastern Cooperative Oncology Group (ECOG):>2
3.Patients with renal stone disease with CKD with serum creatinine <2/eGFR>60.
4.Patients with bleeding diatheses and pregnant women.

Patient included in study underwent standard battery of investigations as for surgical profile including KFT and Non contrast CT KUB.

eGFR was calculated in all patients using MDRD Equation and CKD was classified using the National Kidney Foundation Kidney Disease Outcome Quality Initiative classification system(8). Pre PCNL serum creatinine and eGFR measurement was done one day prior to the surgery.
Those patients presenting with obstruction were stabilized with surgical decompression using percutaneous nephrostomy or double j stent. eGFR was recorded post stabilization following which patients underwent surgery.

SURGICAL TECHINQUE
Patients underwent standard Prone PCNL using 21fr rigid nephroscope ,at the end of procedure a 20 fr nephrostomy tube with dj stent was placed. Patients were discharged when recovered/stable. Complete stone clearance was defined as no visible calculi in X ray/USG -KUB or NCCT KUB if clinically indicated. Patients were followed up at regular intervals of 1,3,6 months.
Preoperative CKD stage and eGFR were compared with measurements made at 1,3 and 6 months follow-up visit. Patients were followed by changes in CKD (eGFR) whether improved/stable or worsened after procedure and divided into two groups:
Group 1 – improved or stable disease and
Group 2 – worsened disease
The effects of independent variables on kidney function after PCNL were evaluated by comparing two groups.

OBSERVATION AND RESULTS
A total of 30 patients with CKD with RSD underwent PCNL in the period from March 2020 to August 2021. 9 patients had bilateral RSD, while the remaining 21 patients had calculi in unilateral kidney, out of these 7 patients had solitary functional kidney(contralateral Atrophic kidney).Thus a total of 39 renal units in 30 patients underwent PCNL.

DEMOGRAPHIC PARAMETERS
Mean ± SD age was 45.60 ± 11.77, the youngest being 24 and the eldest being 65years of age. 21 were male and 9 were female.

COMORBIDITIES
It is observed that most common comorbidities was HTN (Hypertension) found in 11 (36.66%) and recurrent UTI in 6 (20%) patients respectively. DM was found in 5(16.66%) patients. Both DM and HTN were found in 2(6.66%) patients. ACAD, Chronic pancreatitis, ADPKD, urethral stricture and BPH was found in 5(16.66%),2(6.66%),1(3.33%) and 1 (3.33%) patients respectively.

CKD STAGE DISTRIBUTION
Patients were preoperatively classified as having CKD stage 1,2,3,4,5 respectively according to KD0QI classification. None had stage 1 or 2 CKD while 8, 27 and 4 were classified as CKD stage 3,4 and 5 respectively. It is illustrated in the following table as below.

TABLE -1

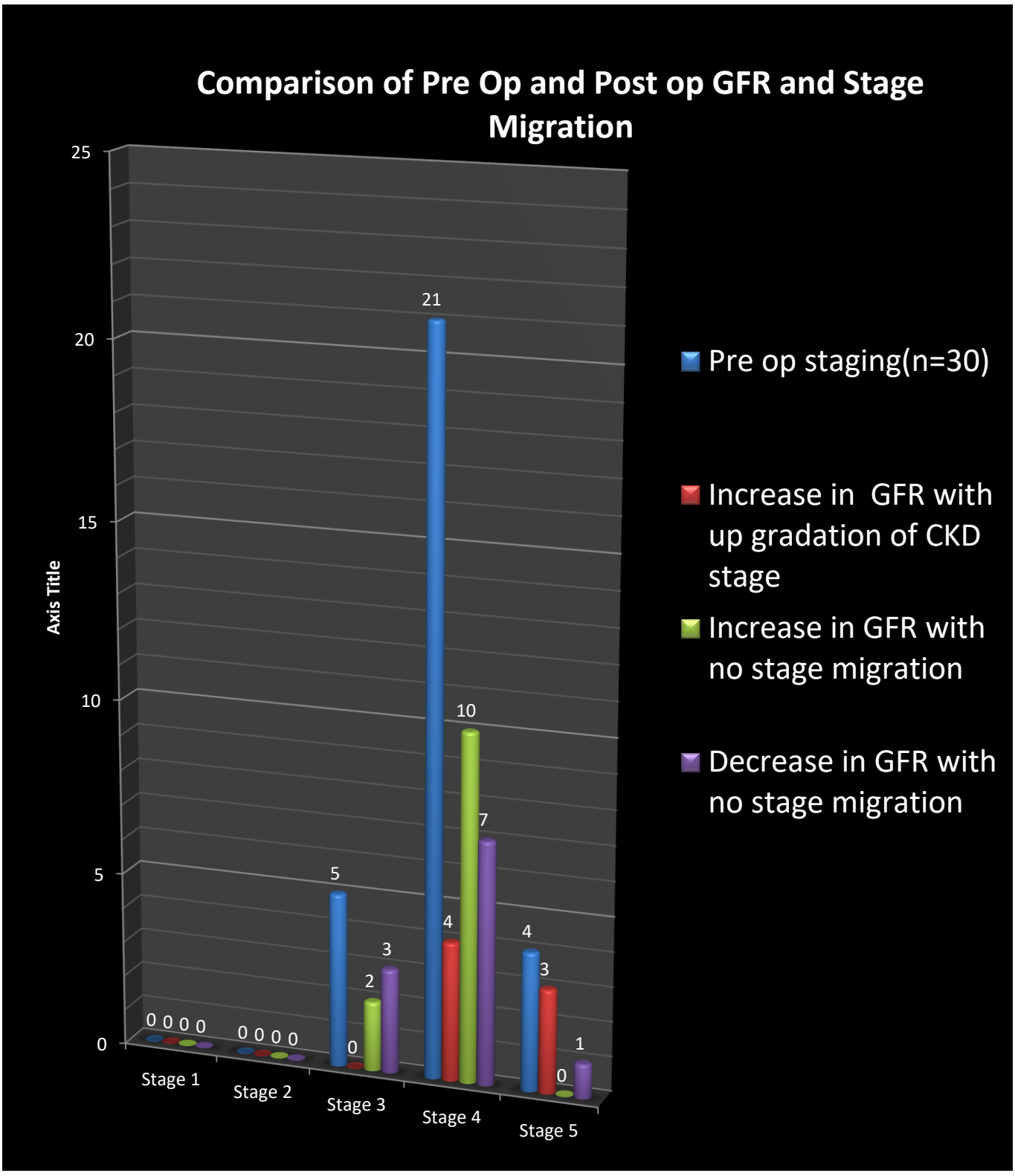
STAGE	GFR(ml/min/1.73m2)	NO.OF PATIENTS	PERCENTAGE
1	>=90	NIL	NIL
2	60-89	NIL	NIL
3	30-59	5	16.66%
4	15-29	21	70.00%
5	<15	4	13.33%

COMPLICATIONS
In this study we have observed a total of 23 complications occurred in 18 Patients. Most common complication was bleeding requiring blood transfusion seen in 10(25.64%).Three (10.0%) patients developed fever in the postoperative period which resolved with antipyretics. 7 (17.94%) developed urosepsis in the postoperative period.

FOLLOW UP
eGFR value during follow up
At 6 months follow up eGFR improved or stabilized in 19 (63.33%) while in 11(36. 67%) patients eGFR deteriorated.

Comparison of pre op and post op GFR and CKD stage migration
At 6 months follow up a total of 4(19.04%) and 3(75%) patients of CKD stage 4 and 5 respectively had improvement in GFR as well as CKD stage. 2(66.66%) and 7(33.33%) patients of CKD 3 and 4 stage had improvement in GFR but not significant enough to cause stage migration. 3(60.0%),7(33.33%) and 1(25.0%) patients of CKD stage 3,4 and 5 had reduction in GFR but not significant enough to cause stage migration . None of the patients had worsening of CKD stage.

FIG -1



DISCUSSION

CKD is a major public health problem, and in the surgical setting, not only it is associated with higher risk of anesthetic complications, but also greater risk of post-procedure complications. 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.

In our study, mean age of patients was 45.60 ± 11.77 years which was comparable to other studies by Kurien et al., Bilen et al., where the reported mean age of distribution varied from 45-59.5 years.

The mean preoperative eGFR was 22.82 ± 6.63 (mL/min/1.73 m2), which was lower than that reported in literature (16, 17). This could be due to the inclusion criteria of higher serum creatinine > 2 mg/dL in our study, which was higher than inclusion criteria (eGFR <60/Serum creatinine >1.5) taken in these studies.
Five (16.66%) patients had diabetes. This was comparable to the incidence of DM in studies reported by Akdeniz et al., Akman et al., Sairam et al. and 11 (36.66%) patients had hypertension. There has been large variation in the reported incidence (8.6-42%) of hypertension in other studies. Jones et al. in a systemic review of 9 studies (n=1851), reported 30.7% incidence rate of hypertension which was comparable to our study.
The mean operative time was 113.33 ± 39.56 (range 40-174) minutes, which was higher than those reported in literature. This could be due to trainees performing some of the procedures, leading to longer operative time or due to more complex stones (53.84 % GSS 3 or 4). None of other studies reported stone burden in form of GSS but mean stone size in these studies was 706.8 mm2 (range 357-1484 mm2).
Single access was gained in 64.1% of cases with a mean of 1.35 punctures/renal unit. This was slightly lower compared to various studies that report frequency of single access to be 68-80%. This could be due to the high frequency of complex calculi (GSS 3-4, 41.7%) which required multiple access to achieve maximal stone clearance. Complete stone clearance was achieved in 84.61% cases which is also in concordance with that reported in literature (70-90%) .

Complications
Three (10.0%) patients developed fever (grade 1) which was managed successfully by conservative management. Blood transfusion due to postoperative drop in hemoglobin was the most common complication seen in 10 (25.64%) patients. This was similar to the reported incidence of blood transfusion in various studies from 9.6-36% . Such high rates of blood transfusion could be attributed to pre-existing anemia and platelet dysfunction in CKD patients.

FOLLOW-UP RENAL FUNCTION
Mean eGFR during the preoperative period, and at 6 months follow-up was 22.82 ± 6.63 and 26.10 ± 8.19 mL per minute/1.73 m2 respectively. Overall renal function improvement was seen in 19 (63.33%) patients, while in 11 (36.66%) patients it deteriorated. This was in concordance with overall improvement in renal function seen in reported literature. Two (40.0), 14 (66.66%) and 3 (75.0%) patients in stage 3, 4, 5 showed improvement in eGFR post intervention respectively. Kurien et al. in their study suggested that an improvement in eGFR was greater in patients with mild to moderate renal failure than in those with severe CKD. It would be reasonable to assume that those patients with severe renal failure would be less likely to gain benefit, principally because the damage already done to the kidney was severe and irreversible.

Conclusion
PCNL can be carried out with acceptable complication rates in patients with CKD. Comorbidities, perioperative complications such as bleeding and recurrent UTI and significant proteinuria are associated with deterioration of renal function.
Postoperative complications are significantly associated with negative outcomes and hence one should be cautious to prevent them or manage them aggressively for a successful outcome.

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