Original Article

Percutaneous nephrolithotomy of horseshoe kidney: Our institutional experience

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Abstract

Purpose: To review our success in PCNL for managing large horse shoe kidney stones as primary treatment .

Method: Between 2012 and 2016, a total of 23patients (24 renal units) underwent percutaneous renal surgery for stone dieses in horseshoe kidneys. Indications were HSK with stone more than 1 cm in size and failed ESWL.

Results: Mean age was 35.60 ± 10.10 years out of which 18 were males and 5 females .One patient had stone in both kidneys. Mean stone size was 22.03 ± 10.33 mm . Access site was upper calyceal and subcostal in all patients. In 2 patients an extra middle calyceal puncture were used for total clearance (8.69%). Mean operation time was 67.22 ± 7.63 minutes. One patient with staghorn stone was converted to open surgery because of inaccessibility of the stone and complexity of the renal calyceal system. Post operatively, 2 renal units with residual stone more than 8mm were cleared with ESWL. Complete clearance was achieved in 21 renal units with PCNL (87.50%). There was no significant intra operative complication. Post operatively 2 patients developed fever which was treated conservatively(clavien grade I).

Conclusion: PCNL can be recommended as first line of management in the treatment of horseshoe kidneys with large stone burden considering its higher clearance rate and minimal complications.

Keywords: Horseshoe kidney, percutaneous nephrolithotomy, Kidney anomalies, urolithiasis, Eswl

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INTRODUCTION

Horseshoe kidney (HSK), initially described by Berendagio Carpi in 1522,[1] is one of the most common fusion anomalies of kidney, with a prevalence of 1 in 400–800 of the normal population.[2] During embryogenesis (4th to 8th intrauterine life), the lower poles are fused together, which prevents independent rotation and ascent of kidney. The ureter on the renal pelvis is displaced superiorly and laterally due to malrotation of kidneys. One-third cases of HSK are associated with ureteropelvic obstruction. Patients with HSK are very susceptible to urinary tract infection (UTI), renal calculi, and obstruction due to stasis. Incidence of stone disease in HSK is roughly about 20% of the population.[3] Recently, different modalities of treatment have been introduced including percutaneous nephrolithotomy (PCNL), extracorporeal shock wave lithotripsy (ESWL), and retrograde intrarenal surgery (RIRS). Of these, PCNL is one of the recommended modalities to treat HSK with stone disease. In 1973, Fletcher

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and Kettlewell reported the first PCNL in HSK.[4] Since then, percutaneous extraction of medium- to large-sized stones and failed lithotripsy stones is adopted widely as the standard treatment method. Percutaneous puncture of the HSK is found to be relatively safe because of favorable calyceal orientation and vascularity. There have been few studies in which HSK was managed by ESWL or PCNL in which PCNL has shown a better clearance rate than ESWL, and it was no more difficult to do PCNL in the kidney with normal anatomy.[5,6] A higher success rate with minimal complication has been observed in PCNL with HSK in numerous studies.[6-10] In this study, we reviewed our 5-year experience with PCNL for stones in HSK.

METHODS

During 2012–2016, a total of 23 patients with HSK had undergone PCNL in our institution. Indications were HSK with stone >1 cm in size and failed ESWL or recurrent stones. A detailed patient assessment was done including medical history, physical examination, urine examination, renal function test, ultrasonogram (USG), intravenous pyelography (IVP) [Figure 1], and computed tomography (CT) urography [Figure 2] in the indicated patient.

Ethical Committee granted approval for the study. Between 2012 and 2016, a total of 23 patients (24 renal units) underwent percutaneous renal surgery for stone diseases in HSKs. Stone size was measured by the maximum diameter of stone. In case of multiple stones, the sum of all the stone diameters was considered as the stone size.[8] These patients were offered PCNL as a primary management. Two patients with stones <2 cm underwent PCNL, following failed ESWL after three sessions.

In all patients, a detailed medical history was taken and clinical, and laboratory investigation was done.

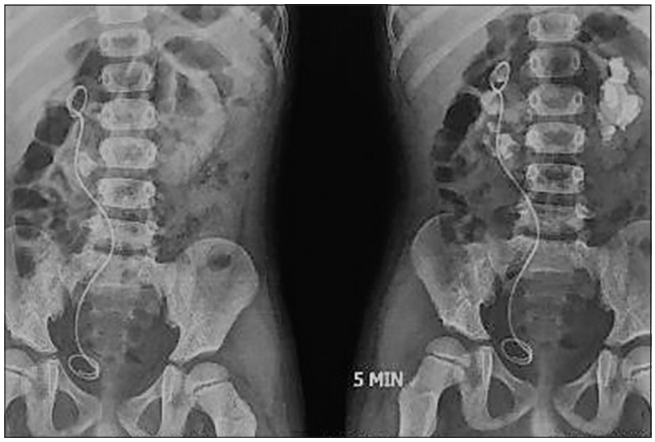

Figure 1: Intravenous pyelography of a patient with stone in horseshoe kidney with DJ stent *in situ* with right renal pelvic stone

USG and IVP were done in all patients. Informed/written consent was taken before performing surgery. Preoperatively, urine culture sensitivity was done in all patients. Any infection detected in urine c/s was treated with a proper antibiotic. All the patients were given one dose of preoperative antibiotic (1 g cefotaxime i.v.). Patient data collected were stone size, site, location, stone-free rate (SFR) in the primary procedure, surgery time (from puncture to nephrostomy tube placement), complications according to Clavien grade, hospital stay, and ancillary procedures if any. After data collection, statistical analysis was done.

Procedure

All the surgeries were performed under general anesthesia. Cystoscopy was done, and ureteric catheter was placed in the kidney in lithotomy position. Patient was then turned into prone position.

Retrograde pyelography was done under C arm guidance. Appropriate puncture site was identified, and c arm-guided puncture was taken with an 18-gauge IP needle in the desired calyx. Either triangulation or bull's eye technique was used. All punctures were upper calyceal and subcostal.

Once the puncture is taken in the desired calyx, a guidewire of 0.035 mm with a straight tip was introduced through the needle into the collecting system. Dilatation was done with a metal dilator. Amplatz sheath was passed over the dilator in the system. Nephroscopy was done using 18 Fr rigid nephroscope. Stone fragmentation was done using pneumatic lithoclast or holmium laser, and larger fragments were removed with biprong forceps.

Additional calyceal puncture was taken as per the need. After stone removal, antegrade JJ stenting was done in every case. Nephrostomy was kept. An X-ray KUB (kidney, ureter, and bladder) was taken on postoperative day 2 for residual stones. All the ancillary procedures which were required for total clearance and any complication related to surgery were noted in the study.

RESULTS

The mean age of the patients was 35.60 ± 10.10 years (ranges between 9 and 50 years), of which 18 were males and 5 were females. Twelve patients had a stone in the right side, ten patients had left-sided stone, and one patient had stone in both kidneys. Two patients underwent ESWL previously which failed to clear the stone burden completely. One patient had a history of prior renal surgery (pyelolithotomy on one side). Most of the patients presented with flank

pain. Besides flank pain, three patients presented with microscopic hematuria. Three patients had a history of recurrent UTI. One patient had only history of hematuria. On further investigation, he was diagnosed with kidney stone. Renal functions were normal in all patients, and there were no comorbidities associated. The characteristics of the patients are described in Table 1. The mean stone size was 22.03 ± 10.33 mm (10–60 mm). Eleven renal units (45.83%) had only pelvic stones; five units (20.83%) had pelvic and lower calyceal stones; four units (16.67%) had isolated stones in the pelvis, middle, and upper calyx; and three units (12.5%) had staghorn stones (stone in pelvis and at least two calyx simultaneously). One unit had (4.17%) isolated upper calyceal stone. Access site was upper calyceal and subcostal in all patients [Figure 3]. In two patients, an extra middle calyceal puncture was used for total clearance (8.69%). All surgeries were performed by a trained urologist. The mean operation time was 67.22 ± 7.63 min. One patient with staghorn stone was converted to open surgery because of inaccessibility of the stone and complexity of the renal calyceal system. Two renal units with residual stone >8 mm were cleared with ESWL at 3 weeks of follow-up. In our study, complete clearance was achieved in 21 renal units with PCNL (87.50%). Intraoperative bleeding or postoperative hemoglobin drop was not clinically significant; and no case required blood transfusion intra- or postoperatively.

No significant intraoperative complications such as excessive bleeding, pelvic perforation, and bowel injury were encountered. No major complication was encountered postoperatively apart from two patients developing fever (Clavien Grade I) which was treated conservatively with antipyretics [Table 2].

DISCUSSION

Due to its anatomical abnormalities and drainage problems, urolithiasis is a commonly faced problem, with HSK affecting approximately 21%–60% of cases.[9]

With newer advancements in urology, different minimally invasive treatment modalities are available to manage stone disease in HSKs. Apart from ESWL, endourological procedures such as PCNL, ureteroscopy, and RIRS have evolved immensely and are used depending on the stone size and the number and location of the stones. ESWL in the treatment of urolithiasis in kidney anomalies has shown good results and can be considered as a reliable, safe, and noninvasive method and often used to treat HSK stone <2 cm with adequate drainage. In patients with large stones and anatomical abnormalities associated with HSK such as high insertion of ureter post-ESWL stone fragment, clearance is not adequate. The average SFR with ESWL is around 53% and ranged between 50% and 79%.[3] On the other hand, PCNL has shown the better result with fewer complications to remove calculi from HSKs and is accepted as a routine treatment of large calculi in HSK. In spite of abnormal positional anatomy of HSK, the vascular anatomy of these kidneys is favorable for PCNL. The dorsomedial or dorsolateral orientation of the collecting system offers good access for PCNL.[5]

In various studies, PCNL is considered as the preferred treatment modality with minimal complications for large stones in HSK[7,8,10-14] and shows a high SFR ranging from 71% to 88%.

Table 1: Characteristics of patients

Renal unit	
One	22 (95.65)
Two	1 (4.35)
Mean age, years (range)	35.60±10.10 (9-50)
Mean stone size, mm (range)	22.03±10.33 (10-60)
Location (%)	
Right side	12 (52.36)
Left side	10 (47.60)
Bilateral	1
Gender (%)	
Male	18 (78.27)
Female	5 (21.74)
Presentation (%)	
Pain	15 (65.27)
Hematuria	1 (4.34)
Pain and hematuria	3 (13)
Pain with UTI	3 (13)
Number of stones, *n* (%)	
Single	14 (60.87)
Multiple	9 (39.13)
Indication of PCNL, *n* (%)	
Stone	20 (86.95)
Failure of ESWL	2 (8.69)
Recurrent	1 (4.34)

UTI: Urinary tract infection, PCNL: Percutaneous nephrolithotomy, ESWL: Extracorporeal shock wave lithotripsy

Table 2: Percutaneous nephrolithotomy result in horseshoe kidney

Stone site in 24 renal units	
Pelvis	11 (45.83)
Mixed	9 (37.50)
Staghorn	3 (12.5)
Upper	1 (4.17)
Access site, *n* (%)	
Superior calyx	23 (100)
Extra middle calyx	3 (13.03)
Complications, *n* (%)	
Fever	2 (8.70)
Paralytic ileus	1 (4.35)
Transfusion	0
Stone-free rate (%)	87.50

In most of the studies, the upper pole puncture was the first preference (62%–81%). Some authors recommend flexible nephroscope for PCNL in HSK; however, with upper pole access with a rigid nephroscope, the entire pelvicalyceal system can be accessed easily, even upper ureter, due to the alignment of the nephroscope with the long axis of HSK. In our study, the access to the kidney was through the upper calyx in all the cases (24 renal units); a middle calyceal puncture was required in 13.04% of cases (2 units) for complete clearance. Hence, complete clearance only through the upper tract was in 21 cases, i.e., 87.50%. Razvi and Zaidi[15] in 2005 performed PCNL in 16 patients, of which in 13 patients (80%), a tract was made with a SFR of 93%. For stone fragmentation, we used pneumatic Swiss lithoclast or holmium laser. Two patients with residual stones were treated with ESWL for complete clearance postoperatively at follow-up in 3 weeks. In our study, 21 of 24 renal units were given 100% stone clearance. SFR of our study is 87.50%. Numerous studies showed high SFR, with PCNL in HSK stone disease ranging between 71% and 87.5%. In 2009, Ghoneimy *et al*.[8] had performed PCNL in 21 renal units of HSK, with higher SFR of 85.7%. In 2012, Etemadian *et al*.[13] have published a paper which shows lower SFR of 71.40% in comparison with our study. This could be because the mean stone size was greater in their study. Several other studies showed lower SFR compared to our study as shown in Table 3.

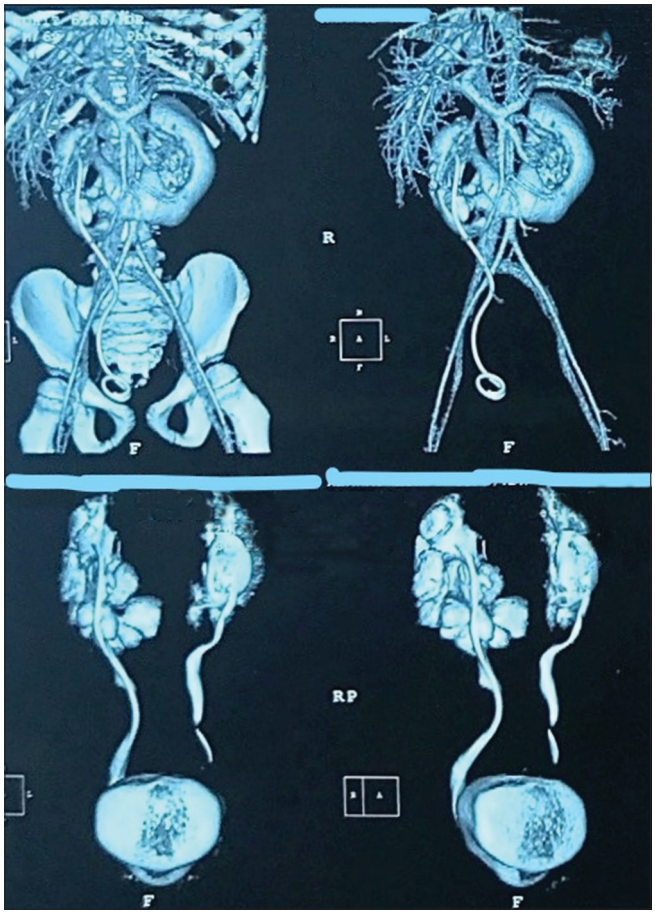

Figure 2: Computed tomography urography with three-dimensional reconstruction

Some authors[7] al oitibi recommend CT scan abdomen in all HSK cases before surgery. In our circumstances, we did a CT scan in one patient who was previously operated (pyelolithotomy) to delineate the bowel and calyceal anatomy in a better fashion. We did CT

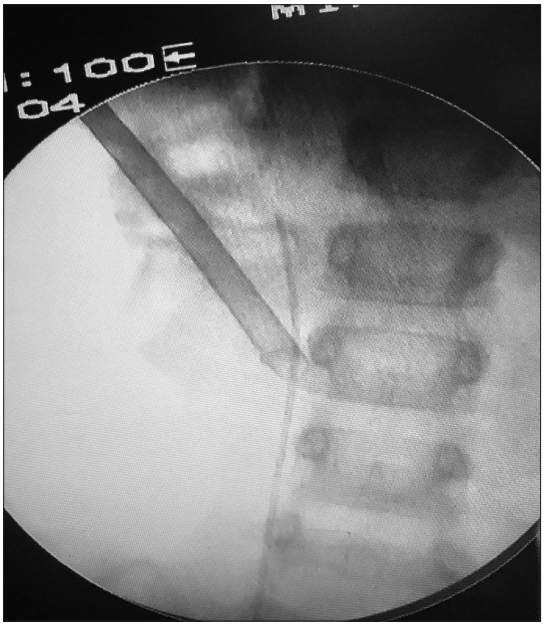

Figure 3: Intraoperative fluoroscopy image shows complete clearance with upper calyceal puncture

Table 3: Comparison of previously published series of percutaneous nephrolithotomy in horseshoe kidney with present series

References	Number of patients	Percentage upper pole access	Percentage complications (minor/major)	Percentage initial stone-free rate
Jones *et al*.[6]	15	Not available	26 (20/6)	72.3
Al-Otaibi and Hosking[7]	12	75	42 (42/0)	75
Shokeir *et al*.[16]	34	46	13 (0/13)	82
Stephanie *et al*.[14]	47	48	23 (9/2)	88
El Ghoneimy[8]	17	48	19 (14/5)	85.7
Etemadian *et al*.[13]	21	NA	14 (14/0)	71.4
Present series	23	83%	13 (13/0)	87.50

NA: Not available

urography with three-dimensional (3D) reconstruction [see Figure 2]. 3D CT urogrography shows excellent calyceal anatomy and stone location and can be replaced with intravenous urogram.

Major complications such as colonic perforation and pelvic rupture were stated in various studies.[8,16] We did not encounter any major complication during our study. Only two patients developed postoperative pyrexia (Clavien Grade 1) which were managed conservatively with antipyretics. One patient was converted to open surgery because of large stone burden and complexity of calyceal anatomy. Postoperatively, this patient developed paralytic ileus, which was subsided with conservative management (Clavien Grade I).

Postoperatively, stent removal was done after 3 weeks. We followed up our patient at 1-month, 3-month, and 6-month interval.

There were no significant complications noted in the study; hence, we confirm the efficacy of PCNL in the management of stone disease in HSK.

CONCLUSION

PCNL can be recommended as the first line of management in the treatment of HSKs with large stone burden, considering its higher clearance rate and minimal complications.

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Nil.

Conflicts of interest
There are no conflicts of interest.

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