

## Percutaneous Management of Urinary Calculi in Horseshoe Kidneys

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Urolithiasis in horseshoe kidney presents a unique challenge in decision-making and technical aspects of calculus treatment. We present our experience with a group of patients with symptomatic calculi in their horseshoe kidneys. We had 8 patients with 9 horseshoe kidneys bearing calculi. They all underwent percutaneous nephrolithotomy. The median size of the calculi was 21 mm (range, 12 to 45 mm). Auxiliary therapeutic procedures were required in 2 patients who had residual calculi on control imaging. The stone-free status was observed in 6 patients (75.0%) at discharge, and in 7 (87.5%) after 3 months of follow-up. Surgical complications included bleeding in 2 patients that was controlled with complete bed rest and blood transfusion, and pleural injury in 1 which was managed conservatively.

Occurring at an incidence of 20% to 60%, urolithiasis is the most common complication of horseshoe kidneys.<sup>(1,2)</sup> Calculi in horseshoe and ectopic kidneys present unique challenges in decision-making and technical aspects of treatment.<sup>(3)</sup>

Although, adequate fragmentation could be achieved by extracorporeal shock wave lithotripsy (SWL), the anatomic abnormality prevents passage of fragments.<sup>(2,4)</sup> The stone-free rate is only 53% (range, 50% to 79%) for calculi in horseshoe kidneys treated with SWL.<sup>(5,6)</sup> In contrast, percutaneous nephrolithotomy (PCNL) has been shown to be highly successful with an overall stone-free rate of 75% to 100% in a few series.<sup>(2,5,7,8)</sup>

We present our experience with PCNL in a group of patients with symptomatic calculi in a horseshoe kidney.

In Tohid Hospital of Sanandaj,

a city in the west of Iran, we performed PCNL for 8 patients (5 men and 3 women) with horseshoe kidney from 2004 to 2006. One patient had bilateral involvement, and therefore, underwent PCNL in both kidneys. There was at least 1 calculus larger than 2 cm in all of the patients. The indications of performing PCNL were complex multiple calculi in 2 patients, staghorn calculus in 5, and failed SWL in 2.

Laboratory tests included complete blood count, blood urea nitrogen, serum creatinine, fasting blood sugar, serum sodium, serum potassium, and blood group and Rh. Radiological assessments were done by plain abdominal radiography, intravenous urography (IVU), and ultrasonography in all of the patients. All of the calculi were opaque with different degrees on

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radiography. Size and number of calculi were determined by IVU and ultrasonography.

Retrograde catheterization was performed under general anesthesia in the supine position. The targeted access was identified with changing the patient's position into prone using fluoroscopic guide. The desired access was achieved using telescopic dilator under fluoroscopic guide. Visualization through fluoroscopy was performed with either air or contrast medium. Cutaneous access was achieved through the subcostal, intercostals, and both areas in 3, 1, and 5 cases. Access to the pyelocaliceal system included the upper calyx in 2, lower calyx in 1, and both calyces in 6 cases. A rigid nephroscope was used in all of the patients. The pneumatic lithotripter was used to fragment the calculi. After passage of the fragment, fluoroscopic control was done via the nephrostomy. The day after the operation, the ureteral catheter was removed and a control plain abdominal radiography was done. Nephrostomy tube was removed on the next day. All of the procedures were performed by one surgeon.

The median age of the patients was 35.5 years, and their median calculus size was 21 mm in diameter. Characteristics of the patients and their calculi are listed in Table 1. The mean operative time was  $150.9 \pm 33.1$  minutes. The mean dose of administered postoperative analgesics was  $81.25 \pm 37.2$  mg. Auxiliary therapeutic procedures were required in 2 patients who had residual calculi on control imaging; 1 patient underwent ureteroscopy and 1, SWL. The mean hospitalization period was  $3.9 \pm 0.8$  days (range, 3 to 5 days). The calculus composed of

calcium oxalate in 3 patients; calcium oxalate and struvite in 1; calcium phosphate and uric acid in 1; calcium oxalate, calcium phosphate, and uric acid in 1; calcium oxalate and calcium phosphate in 1; and calcium oxalate and uric acid in 1. The stone-free status (absence of calculi or residual fragments larger than 4 mm) was observed in 6 patients (75.0%) at discharge, and in 7 (87.5%) after 3 months of follow-up. Table 1 depicts the outcomes. Finally, surgical complications included bleeding in 2 patients that was controlled with complete bed rest and blood transfusion, and pleural injury in 1 which was managed conservatively.

In majority of previous studies on urinary calculi, percutaneous method has been reported safe and successful for the treatment of patients having horseshoe kidney.<sup>(2,7-9)</sup> However, some limited studies have disputed the efficacy of PCNL and reported a high risk of complications in these patients.<sup>(5,10)</sup> To our knowledge, PCNL is frequently for the calculi of horseshoe kidneys by the urologists in Iran, and they have reported satisfactory outcomes in their patients.<sup>(11)</sup> Our stone-free rate was 75% in the patients at discharge and 87.5% three months postoperatively, being in coordination with the figures of the previous studies with successful results (75% to 100%).<sup>(2,5,7-9,11)</sup> Some of main features of this series along with those of the previous studies are listed in Table 2.

It is important to consider 2 factors concerning the differences in blood supply and the position of the collecting system in horseshoe kidneys during percutaneous surgery. The majority of

**Table 1.** Demographic and Clinical Data of Patients With Horseshoe Kidney and Calculi

Patient	Age, y	Sex	Number of Calculi	Calculus Location	Involved Kidney	Operative Time, min	Complication	Blood Transfusion, U	Pethidine, mg
1	19	M	1	Pelvis	Right	124	No	0	25
2	45	M	3	Staghorn	Left	193	Pleural injury & Bleeding	2	50
3	29	F	2	Calyx & Pelvis	Left	160	No	0	25
4	63	M	3	Staghorn	Right	173	No	0	50
5	37	F	1	Pelvis	Left	96	No	0	25
6	52	M	3	Staghorn	Right	135	No	0	50
7	34	M	2	Calyx & Pelvis	Left	140	No	0	25
8	26	F	3	Staghorn	Both	186	Bleeding	2	75

**Table 2.** Published Studies on Percutaneous Management of Calculi in Horseshoe Kidneys\*

Study	Number of Patients	Calcium Calculi, %	Upper Pole Access, %	Stone Free, %	Secondary Procedure, %	Complications	
						Minor, %	Major, %
Raj et al <sup>(5)</sup>	24	87.5	64.0	87.5	33.0	16.7	12.5
Lingeman and Saw <sup>(12)</sup>	17	...	81.0	84.6	73.0	24.0	5.0
Jones et al <sup>(13)</sup>	15	53.3	NA	88.8	13.3	20.0	6.0
Al-Otaibi and Hosking <sup>(10)</sup>	12	83.0	75.0	75.0	8.3	42.0	0
Darabi Mahboub et al <sup>(11)</sup>	9	...	...	66.7	33.3	...	...
Present series	8	100.0	88.8	87.5	25.0	12.5	25.0

\*Ellipses indicate that data were not available.

blood vessels enter the horseshoe kidney through the ventromedial region; however, the possibility of hemorrhage does not necessarily confine percutaneous access to the opposite side of these vessels. On the other hand, the probability of arterial hemorrhage is not more likely than that in a normal kidney, because the dorsal vessels supplying the isthmus are supported with the vertebrae and are far from the nephrostomy tract.<sup>(2)</sup>

In the present study, upper pole access was used in 89% of the kidneys compared to 64% to 81% cited in other studies.<sup>(2,5,10)</sup> The use of this method provides access to the upper pole, calyces, renal pelvis, lower calyx, ureteropelvic junction, and proximal ureter. Raj and coworkers believed that using upper pole access decreases hemorrhage, because the nephroscopic axis is along with the kidney's longitudinal axis resulting in restriction of nephroscope movement.<sup>(5)</sup> However, in a study from Egypt, upper caliceal puncture was shown as a risk factor of severe bleeding.<sup>(14)</sup>

It is remarkable that although some researchers consider flexible nephroscope for upper pole access essential,<sup>(5)</sup> we achieved comparable results with a rigid nephroscope (flexible nephroscope was not available at our center).<sup>(2,5,7-9)</sup>

These results are justifiable considering that the majority of our access attempts were from the upper pole, providing the opportunity to observe more calyces by rigid nephroscope, and also that we used two access sites in case of poor access. Another explanation is that we did not have overweight patients in whom access is more difficult. Nonetheless, the use of flexible nephroscope seems to be associated with higher overall success rates.

In patients with normal kidney anatomy, upper pole access often requires supracostal approach that may cause intrathoracic complications.<sup>(15)</sup> Contrary to normal kidneys, the upper pole access is not supracostal in horseshoe kidneys (due to the different position of the kidney). Thus, the risk of pleural injury is not high. In our study, only 1 patient suffered from pleural injury that was managed conservatively. Pneumothorax has been reported to occur in 6% of the patients with horseshoe kidney.<sup>(5)</sup> The main complication in our study was excessive hemorrhage (25%) which is frequently seen in these patients (12.5% to 42%).<sup>(2,5,10)</sup>

In summary, our experience in PCNL for horseshoe kidneys confirms the results of the previous studies. As a consequence, in our opinion, PCNL can be recommended for the treatment of kidney calculi in patients with horseshoe kidney as a safe and effective procedure.

## CONFLICT OF INTEREST

None declared.

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