

LATERAL PERCUTANEOUS NEPHROLITHOTOMY IN HORSESHOE KIDNEY: AN ALTERNATIVE APPROACH WITH HIGH SUCCESS RATE

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ABSTRACT

Objective: This case report was aimed to present a lateral percutaneous nephrolithotomy (PCNL) approach for a patient with horseshoe kidney, few comorbidities, and the outcome of this procedure. **Case(s) presentation:** A 70 years old obese male came into our hospital with pain in the left flank. Upon CT scan examination, we found that the patient has Horseshoe kidney with left hydronephrosis. The hydronephrosis resulted from obstruction caused by left kidney pelvic stone with a size of 25 x 20 mm. We decided to do lateral PCNL for this case with an excellent result. **Discussion:** With newer advancements in urology, different minimally invasive treatment modalities are available to manage stone disease in HSKs. 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, showing a high SFR ranging from 71% to 88%. Lateral percutaneous access of the renal collecting system is safe, as it is gained on the opposite side to where the renal blood vessels enter the kidney. **Conclusion:** Stone management in patients with horseshoe kidneys is a challenging procedure in endourology, however percutaneous nephrolithotomy is considered a safe and effective treatment option in patients with renal stones in a horseshoe kidney with acceptable result.

Keywords: Horseshoe kidney, percutaneous nephrolithotomy, lateral PCNL.

ABSTRAK

Tujuan: Laporan kasus ini bertujuan untuk menyajikan pendekatan nefrolitotomi perkutan lateral (PCNL) untuk pasien dengan ginjal tapal kuda, sedikit penyakit penyerta, dan hasil dari prosedur ini. **Presentasi Kasus:** Seorang laki-laki berusia 70 tahun yang mengalami obesitas datang kerumah sakit dengan keluhan nyeri pada pinggang kiri. Berdasarkan pemeriksaan CT scan, kami menemukan bahwa pasien menderita ginjal tapal kuda dengan hidronefrosis kiri. Hidronefrosis tersebut disebabkan oleh penyumbatan akibat batu panggul ginjal kiri berukuran 25 x 20 mm. Kami memutuskan untuk melakukan PCNL lateral untuk kasus ini dengan hasil yang sangat baik. **Diskusi:** Dengan kemajuan terbaru dalam urologi, berbagai modalitas pengobatan invasif minimal tersedia untuk menangani penyakit batu di HSK. PCNL telah menunjukkan hasil yang lebih baik dengan komplikasi yang lebih sedikit untuk menghilangkan batu dari HSK dan diterima sebagai pengobatan rutin untuk batu besar di HSK, menunjukkan SFR yang tinggi mulai dari 71% hingga 88%. Akses perkutan lateral dari sistem pengumpulan ginjal aman karena diperoleh pada sisi yang berlawanan dengan tempat masuknya pembuluh darah ginjal ke ginjal. **Simpulan:** Penatalaksanaan batu pada pasien dengan batu ginjal tapal kuda merupakan prosedur yang menantang dalam endourologi, namun nefrolitotomi perkutan dianggap sebagai pilihan pengobatan yang aman dan efektif pada pasien dengan batu ginjal pada ginjal tapal kuda dengan hasil yang dapat diterima.

Kata kunci: Ginjal tapal kuda, nefrolitotomi perkutan, lateral PCNL.

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INTRODUCTION

Horseshoe kidney (HSK), which was first described by Berendagio Carpi in 1522, is one of the most common congenital fusion anomalies of kidney, with a prevalence of 1 in 400–800 of the normal population, and a male-to-female ratio of 2:1.¹⁻² 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.¹ Therefore, the horseshoe kidney remains located in a position more inferior and medial to its normal position.

The insertion of the ureters in HSK is higher and anterior in the renal pelvis due to an anterior location of the renal collecting system.² These might

causes the impairment of urinary drainage from collecting system, resulting in increased incidence of a pelvico-ureteric junction (PUJ) obstructions, infections (24%) and stone formations (20%), according to studies.³⁻⁴ According to a study by Raj et al, 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.⁵

Recently, various 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. 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.¹, ideal patient position would provide good anesthetic conditions and ergonomics with minimal intraoperative complications. The lateral position meets such criteria. Lateral PCNL was first performed on a morbidly obese patient in 1994. It shows promising result, as it is effective in most patients with limitations and comorbidities. Further studies described the anesthetic advantage of lateral PCNL in the morbidly obese or kyphotic patients and the rotation of C-arm fluoroscopy to obtain an anterior-posterior projection and perform nephroscopy simultaneously as seen in Figure 1.⁶ Lateral PCNL is also recommended in patients with severe medical risk factors and comorbidities to optimize clinical

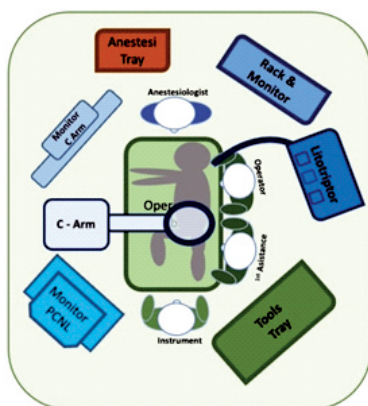


Figure 1. Preparation Phase for Lateral PCNL.

outcome. More recently in 2009, lateral-PCNL has also been performed with ultrasound-guided renal access to reduce the risk of radiation dose.^{6,8}

Despite the developments of lateral PCNL, it is still not widely practiced and hence data on its use remain limited.⁶ Therefore, this case report was aimed to present a case with Lateral Percutaneous Nephrolithotomy (PCNL) approach in a patient with horseshoe kidney, and the outcome of this procedure.

CASE(S) PRESENTATION

A 70-year old obese male came into our hospital with pain in the left flank, which was felt in the last 6 years before being admitted to the hospital. The pain is intermittent, and has a throbbing sensation when it appeared. Complaints of painful urination, urinary stones, sandy urine, and cloudiness were denied. He denied complaints of loss of consciousness, shortness of breath, leg swelling and nausea and vomiting. Because of his complaint, the patient had ESWL taken in 2017 at Hasan Sadikin Hospital in Bandung, Indonesia. Upon CT scan examination, we found that the patient's kidney shape was abnormal (Horseshoe kidney)

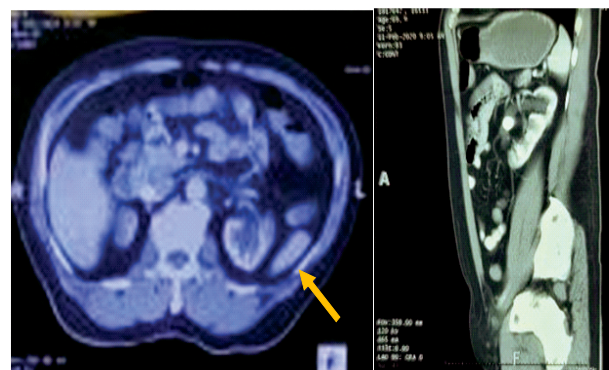


Figure 2. Left hydronephrosis in patient with horseshoe kidney, caused by urolithiasis obstruction with notable retrorenal colon as his comorbidities.

From Figure 2, we can see that the patient suffered from left hydronephrosis which causing him the flank pain he mentioned earlier. The hydronephrosis resulted from obstruction caused by left kidney pelvic stone with a size of 25 x 20 mm. We decided to do PCNL with lateral approach for this case (Figure 3).



Figure 3. Lateral PCNL patient positioning (a), and body site marking (b).

We found that the urethra was in normal size, prostate was not obstructive, and bladder neck is in normal state. Bladder mucosa was normal, no trabeculation, sacculum, nor diverticle was seen. Both ureteric orifices were normal, with positive efflux. We did a left Retropyelography under C-Arm and found a filling defect, which indicates a stone, on left kidney pelvic with a size of 25 x 20 mm with retro renal colon.

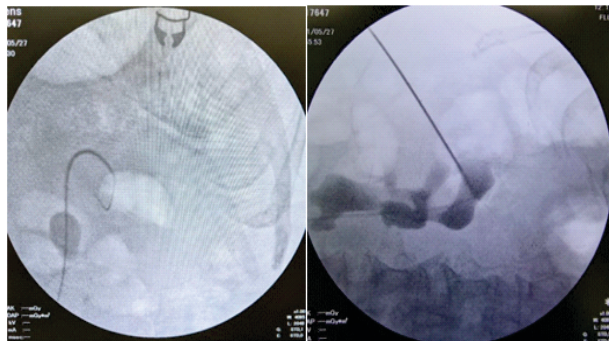


Figure 4. Stone in left kidney pelvic as seen from C-Arm.

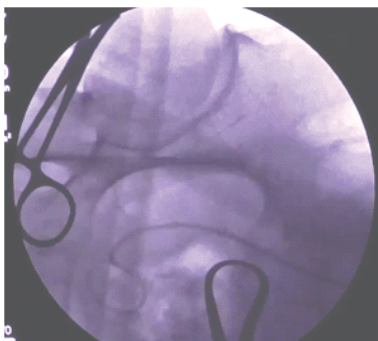


Figure 5. Left DJ stent insertion, with no remaining stone seen in Fluoroscopy.B

Lateral PCNL was done carefully by entering the kidney from upper calyx, avoiding retro renal colon as seen in Figure 4. We break the stone using a pneumatic lithotripter and successfully evacuate all the stone, which indicating that PCNL is indeed an effective procedure with high stone free rate for patients with horseshoe kidney. A stent was installed inside the left ureter to ensure the urinary passage, as seen in Figure 5.

DISCUSSION

Urolithiasis is the most common complication of horseshoe kidney. Stone management in horseshoe kidney is a challenge in endourology. Altered pyelocalyceal system anatomy and high ureteropelvic junction position lead to relatively poor results of SWL and retrograde intrarenal surgery.⁷

With newer advancements in urology, different minimally invasive treatment modalities are available to manage stone disease in HSKs.¹ There are different treatment modalities have been used for treating renal stones in the horseshoe kidney, those were including open surgery, extracorporeal shockwave lithotripsy (ESWL), ureteroscopy and laparoscopic/robotic surgery. Minimally invasive surgery, such as PCNL, and minimally invasive procedures, such as SWL, play a pivotal role in the treatment of stones associated with a horseshoe kidney, while the role of open surgery is considered obsolete.⁷ Several of these modalities have limitations, for instance ESWL has a low stone clearance rate especially in stones larger than 2 cm in size.⁵ Laparoscopic or robotic renal stone surgery is an option with an excellent outcome.⁹ However, these procedures need expertise and specialized equipment.

Percutaneous nephrolithotomy is the routine treatment of large renal stones in a kidney with normal anatomy. It has also been reported as a treatment modality for horseshoe kidney stone as well.⁷ Many urologists believe PCNL to be the ideal procedure for treatment of renal stones in the horseshoe kidney.

PCNL has shown the better result with fewer complications to remove calculi from HSK and is accepted as a routine treatment of large calculi in HSK. This is proven in our case, in spite of abnormal positional anatomy of HSK, the vascular anatomy of these kidneys is favorable for PCNL. The blood supply of a horseshoe kidney originates from the ventral-medial aspect, whereas the isthmus receives its supply either directly by aorta or by the iliac vessels. Therefore, lateral percutaneous access of the renal collecting system is safe, as it is gained on the opposite side to where the renal blood vessels enter the kidney.¹⁰ The dorsomedial or dorsolateral orientation of the collecting system offers good access for PCNL.¹ In various studies, PCNL is considered as the preferred treatment modality with minimal complications for large stones in HSK and shows a high SFR ranging from 71% to 88%.¹¹⁻¹³

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 a study conducted by Satav et al, 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%.¹ Razvi and Zaidi in 2005 performed PCNL in 16 patients, of which in 13 patients (80%), a tract was made with a SFR of 93%.¹⁴ Numerous studies showed high SFR, with PCNL in HSK stone disease ranging between 71% and 87.5%. In 2009, Ghoneimy et al had performed PCNL in 21 renal units of HSK, with higher SFR of 85.7%.¹⁰ In 2012, Etemadian et al. have published a paper which shows lower SFR of 71.40%. This could be caused by the greater mean stone size of their study.¹⁵

A retrorenal colon is more frequently found on the left side and is most likely to be situated near the inferior kidney pole. Retrorenal colon is found in approximatively 0.6% of the general population

according to the Hadar-Gadot and Sherman et al. study. In another study with 333 participants, CT images showed that the left colon was posterior in 16.1% of cases, and the right colon was posterior in 9% of cases at the level of the lower pole. Total ratio of retrorenal colon was 1.7%, with 1.2% on the left side, 0.3% on the right side and 0.2% bilateral in the Atar et al. study. Hopper et al. reported in their study based on 500 abdomen CT scans that the overall frequency of retrorenal colon was 1.9% if the images were taken in supine position. When 90 patients were studied in the prone position, retrorenal colon was found in 10%, as seen in our patient in this study.

Colonic perforation, a rare complication of PNL, is reported in less than 1% of cases. During PCNL, the age of the patient, existence of horse shoe kidney, previous kidney surgery, left kidney inferior location access, lateral posterior axillary line access, hypermobile kidney, and the existence of retrorenal colon are among the factors that predispose to colon perforation.

Minor complications included post-operative transfusion, fever that was controlled by antibiotics, and ileus, which was managed with conservative treatment.¹¹ Major complications such as colonic perforation and pelvic rupture were stated in various studies.^{11,16} The blood supply of horseshoe kidneys, although quite variable, tends to follow an ordered patterns, inasmuch as all blood vessels, except some to the isthmus, enter the kidney from its ventromedial aspect. Furthermore, the dorsal arteries to the isthmus are usually protected by the spine and situated far away from the nephrostomy tract; the risk of arterial bleeding is therefore not higher than in a normal kidney.⁸

Supine position is an alternative option for PCNL with similar outcomes to the PCNL in the standard prone position. It provides an additional benefit of performing the procedure in a single position, which is known to reduce total operating time.²

CONCLUSION

Stone management in patients with horseshoe kidneys is a challenging procedure in endourology, however percutaneous nephrolithotomy with lateral approach is considered a safe and effective treatment option in obese patients with renal stones in a horseshoe kidney with acceptable result. By the increasing experience and skill of the operator, PCNL complications in

horseshoe kidney are similar to normal anatomy kidney. Lateral 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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