

# SINGLE SESSION BILATERAL PERCUTANEOUS NEPHROLITHOTOMY (PCNL) IN HORSESHOE KIDNEY PATIENT WITH BILATERAL STAGHORN STONES: A CASE REPORT

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## ABSTRACT

**Objective:** To analyze the outcomes of single-session bilateral PCNL in a horseshoe kidney patient with bilateral staghorn stones in terms of safety and effectiveness. **Case(s) Presentation:** A 64-year-old woman with bilateral staghorn stones on HSK. She had an anesthesia status of ASA 2, with type 2 diabetes mellitus (uncontrolled with oral medication), 47% of ejection fraction from echocardiography and her body mass index was 21.7 kg/m<sup>2</sup>. A single session of bilateral PCNL was performed, with 150 minutes of surgery and total blood loss of  $\pm$  50 cc. A 4.7 Fr DJ stent was placed on the right kidney, a 5 Fr ureteral catheter was left in the left kidney, and a 16 Fr foley catheter was placed as a right and left nephrostomy. Control plain abdominal x-ray showed no residual stones. Postoperatively, the patient was hospitalized for 3 days, there were no significant complaints and discharged in good condition. **Discussion:** The procedure was performed in the prone position for two reasons. First, is to avoid intestinal injury during puncture and dilatation, the second is to simplify the positioning of the C arm, as well as the endourology monitor, and the other instruments. **Conclusion:** Single-session bilateral PCNL for HSK patients with bilateral staghorn stones, in our experience, is quite safe and effective.

**Keywords:** Horseshoe kidney, single-session bilateral percutaneous nephrolithotomy (PCNL), staghorn stone.

## ABSTRAK

**Tujuan:** Laporan kasus ini membahas keamanan prosedur PCNL bilateral sesi tunggal pada pasien ginjal tapal kuda dengan batu cetak ginjal bilateral. **Presentasi Kasus:** Seorang wanita 64 tahun dengan batu cetak ginjal bilateral pada ginjal tapal kuda. Status anestesi ASA 2, dengan komorbid diabetes mellitus tipe 2 tidak terkontrol dengan pengobatan oral, dan fraksi ejeksi dari ekokardiografi 47%, Indeks Massa Tubuh 21.7 kg/m<sup>2</sup>. Dilakukan PCNL bilateral sesi tunggal, durasi operasi 150 menit, dengan perdarahan  $\pm$  50cc. DJ stent 4.7 Fr dipasang sebagai nefrostomi kanan dan kiri. Foto polos abdomen kontrol pasca operasi tidak ada batu sisa. Pasca operasi, pasien dirawat 3 hari, selama perawatan tidak ada keluhan yang berarti pasien pulang rawat dalam kondisi baik. **Diskusi:** Pada pasien prosedur dilakukan dalam posisi telungkup dengan dua alasan, pertama untuk menghindari cedera usus saat pungsi dan dilatasi, alasan kedua untuk kemudahan penempatan posisi C arm, monitor endourologi, dan instrumen lainnya. **Simpulan:** PCNL bilateral sesi tunggal cukup aman dan efektif dilakukan pada pasien ginjal tapal kuda dengan batu cetak ginjal bilateral.

**Kata kunci:** Batu cetak ginjal, percutaneous nephrolithotomy (PCNL) bilateral sesi tunggal, ginjal tapal kuda.

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## INTRODUCTION

Horseshoe kidney (HSK) is a congenital anomaly in the genitourinary system with an incidence of one every 400–800 births.<sup>1,2</sup> The incidence of HSK in males is higher than in females (2:1).<sup>1</sup> Patients with HSK are more prone to urinary tract infections, kidney stones, and obstruction due to urinary stasis. The incidence of kidney stones in HSK is high, reaching 20–80%.<sup>2,3</sup>

There are several options for treating kidney stones, including Percutaneous Nephrolithotomy (PCNL), Extracorporeal Shock Wave Lithotripsy (ESWL), and Retrograde Intrarenal Surgery (RIRS). In HSK, PCNL is the gold standard for kidney stones > 20 mm.<sup>4,5</sup>

In 1973, Fletcher and Kettlewell reported the first PCNL in HSK patients. Since then, PCNL has become the standard treatment for kidney stones in HSK.<sup>6,7</sup> Percutaneous puncture in HSK is

considered safe because of the orientation of the calyceal system, and vascularity is better visualized by fluoroscopy on retrograde pyelography (RPG).<sup>7-8</sup> Several studies highlight the management of kidney stones in HSK, comparing ESWL and PCNL. PCNL is superior to ESWL in terms of stone-free rate (SFR), with a low complication rate.<sup>7-9</sup> Several studies have also stated that PCNL is safe and effective to be performed bilaterally in a single or simultaneous session (either by two operators or a single operator).<sup>10-12</sup>

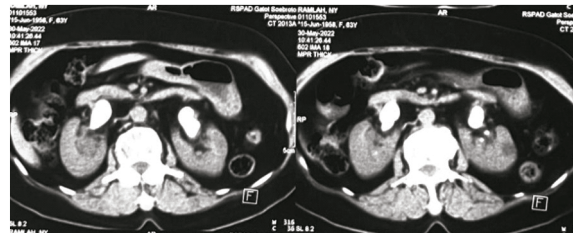
In a retrospective cohort study conducted by Silverstein et al found that patients with bilateral kidney stones who underwent simultaneous bilateral PCNL showed a reduction in the total operative time, hospital stay, total blood loss, and the need for only one anesthesia.<sup>13</sup> Moreover, a systematic review comprising 187 studies conducted between 1997 and 2015 by Jones et al recommends bilateral simultaneous PCNL as an effective endourologic approach for patients with bilateral stone disease. This approach was shown to yield high stone-free rates (SFRs) and maintain a safety profile that is not inferior to the staged approach. However, it is important to note that this technique requires careful patient selection, counseling, and should ideally be performed in endourology centers with a substantial case volume.<sup>14</sup> Satav et al report 1 out of 23 patients who had bilateral stone in horseshoe kidney underwent single session PCNL. They recommend PCNL as the first line of management in the treatment of HSKs with large stone burden, considering its higher clearance rate and minimal complications.<sup>8</sup>

Although PCNL has become the standard of stone management in HSK, single or simultaneous sessions of bilateral PCNL in HSK with bilateral kidney stones remain inconclusive in terms of safety and effectiveness. This study aims to report the safety and efficacy of single-session bilateral PCNL in horseshoe kidney with bilateral staghorn stone in elderly.

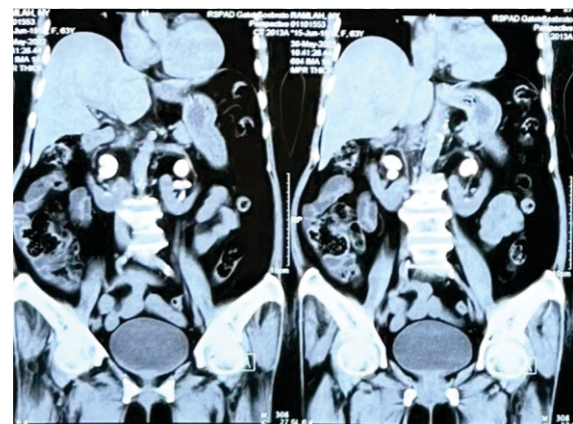
## CASE(S) PRESENTATION

A 64-year-old woman with intermittent bilateral flank pain (especially the left side), for the last two years. The patient was referred to RSPAD Gatot Soebroto by an internist in Sorong. She had several comorbidities: type 2 diabetes mellitus (uncontrolled with oral medication), and 47% of ejection fraction (EF) from echocardiography. Non contrast multislice computerized tomography

(MSCT) scan of the abdomen revealed horseshoe kidney with bilateral staghorn stones with a size of 2.5 x 1.4 cm in the right kidney and 1.7 x 1.2 cm in the left, with hardness level of 610–1103 HU (Hounsfield Unit). The pelvicalyceal system and ureter were well visualized.



**Figure 1.** Axial plane view of abdominal CT scan.



**Figure 2.** Coronal plane view of abdominal CT scan.

The patients had an anesthesia status ASA (American Society of Anesthesiologists) 2, body mass index (BMI) of 21.7 kg/m<sup>2</sup>, and preoperative blood sugar of 278 mg/dL. Cefoperazone 1 g was given intravenously as a prophylactic antibiotic.

PCNL was performed in the prone position under general anesthesia, by single operator who changed positions. Left PCNL was performed first (because the patient complained most on the left flank) then the right side (Figure 3). The puncture was performed using the Eye of the Needle technique (Figure 4).

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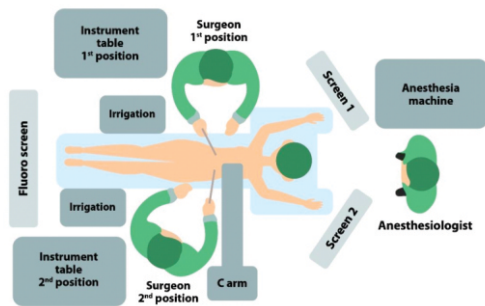
We use an ultrasonic lithotripter. A 4.7 Fr DJ stent was placed on the right kidney, a 5 Fr ureteral catheter (UK) was left in the left kidney, and a 16 Fr foley catheter was placed as a right and left nephrostomy. The procedure was carried out for 150 minutes with a bleeding amount of  $\pm 50$  cc.

Postoperatively, the patient had no significant complaints, only mild pain of Visual

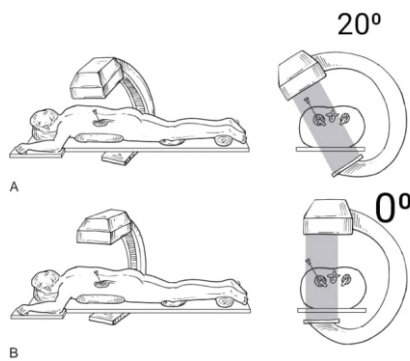
Analogue Scale (VAS) 2-3. Once the patient was conscious, she could tolerate regular diet and 30 degrees of sitting position. On the first postoperative day, a plain abdominal x-ray (BNO) was performed, and there were no rest stones (Figure 3). On the second postoperative day, the right and left nephrostomy were clamped to evaluate the patency of urine drainage distal to the pelvicalyceal system (PCS). Then, 10 hours after clamping, the nephrostomy was removed after no leakage from the nephrostomy site. On the third day, the catheter and left UK were removed. The patient was discharged during day 3<sup>rd</sup>, in good condition. Preoperative and postoperative laboratory parameters can be seen in Table 1. Both of the stone revealed identical stone composition (Table 2).

**Table 2.** Stone analysis.

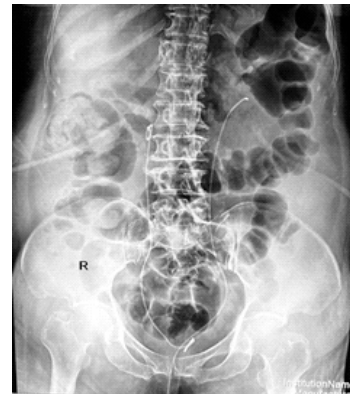
| RESULTS                             |                                    |
|-------------------------------------|------------------------------------|
| The right kidney stone consists of: | The left kidney stone consists of: |
| • Phosphate                         | • Phosphate                        |
| • Uric acid                         | • Uric acid                        |
| • Oxalate                           | • Oxalate                          |



**Figure 3.** Operating theater setup for single-session bilateral PCNL.



**Figure 4.** Imaging modalities: "Eyes of the needle." (A) AP position. (B) Inclined position. Allows evaluation of needle penetration depth.<sup>13</sup>



**Figure 5.** Abdominal x-ray: DJ stent with a proximal tip at the right L2-3 paravertebral and a left L1-2 ureteral catheter with a distal tip was visualized in the pelvic cavity.

**Table 1.** Comparison of lab result pre and post operatively.

| LAB PARAMETERS | RESULTS |                                     | REFERENCE VALUE |
|----------------|---------|-------------------------------------|-----------------|
|                | PRE-OP  | POST-OP                             |                 |
| Hemoglobin     | 12.8    | 13.2<br>(Without blood transfusion) | 12.0–16.0 g/dL  |
| Ureum          | 13      | 39                                  | 20–50 mg/dL     |
| Creatinine     | 0.66    | 0.50                                | 0.5-1.5 mg/dL   |
| Uric Acid      | -       | 3.7                                 | 2.4-5.7 mg/dL   |



## DISCUSSION

The growing elderly population has led to an increased identification of renal stones in older patients. It is crucial to carefully consider the best strategy for addressing renal stones in this demographic. The estimated prevalence of renal stone disease in elderly males and females (age >65 years) is 47.3 and 34.2 per 1000 population, respectively.<sup>15</sup> Geriatric individuals often experience age-related cardiovascular and pulmonary system decline, along with the presence of multiple concurrent medical conditions. Gupta et al showed elderly patients had more comorbid conditions, with the most common being hypertension (42%), followed by diabetes (22%) and COPD (20%).<sup>16</sup> In our case, we present 64-year-old woman with type 2 diabetes mellitus (uncontrolled with oral medication) and 47% of ejection fraction from echocardiography.

In older patients with numerous medical conditions, keeping a watchful eye on small, asymptomatic stones may be a viable approach. Nevertheless, in the elderly, these stones tend to grow at a faster rate, leading to urinary tract infections, blockages, and pain necessitating pain relievers, which can have a detrimental impact on their kidney function. Owing to the risks associated with open surgery, there was always a dilemma about whether to treat them or not. However, advances in endourology have changed the perspective.<sup>16-18</sup>

Single or simultaneous session of bilateral PCNL in bilateral kidney stones is considered quite safe.<sup>8,9</sup> However, bilateral PCNL in HSK with bilateral staghorn stones has its challenges in terms of anomalies of the pelvicalyceal system (PCS).<sup>12,19,20</sup> In this case, we decided to perform bilateral PCNL in a single session considering the far distance of the patient's residence, in Sorong Papua. Therefore, if PCNL was done staged, it would burden her in terms of cost and time.

The procedure was performed in the prone position for two reasons. First, is to avoid intestinal injury during puncture and dilation. In the prone position, the intestine will downward ventrally due to gravity.<sup>20-25</sup> The second, is to simplify the positioning of the C arm, as well as the endourology monitor, and the other instruments. The benefit of the prone position was not necessary to change the patient position, as well as C arm, and endourology monitor, only changing the operator's position. Moreover, the surgery only took a brief time (150 minutes).

Conservatively, PCNL is done in the prone position, which allows direct access to the posterior calyx and provides a safer procedure regarding the location of the bowel. Some of the following benefits are considered an advantage when this position is used.<sup>26-27</sup>

Initially, the potential for puncturing various parts of the urinary tract, even in cases of atypical anatomical configurations, is a consideration. Due to numerous potential puncture locations, we have the flexibility to adjust our approach in instances of unfavorable anatomy, such as ectopia, horseshoe kidney, rotated kidney, hepatomegaly, splenomegaly, scoliosis, and others. Given that the puncture trajectory in the prone position is situated more towards the rear compared to the supine position, in the infrequent scenarios where there is injury to the colon, it is possible to manage it conservatively.<sup>27</sup>

Secondly, the potential to conduct a bilateral PCNL without the need to change the patient's position offers several benefits. Simultaneous bilateral PCNL (SBPCNL) in the prone position presents advantages such as using a single anesthesia, reducing both the surgical and psychological stress on the patient, shortening the operative duration, requiring less medication, and resulting in a shorter hospital stay, which naturally carries cost-saving implications.<sup>27</sup>

Thirdly, the ease of reaching the upper calyx through the lower calyx is another notable feature. One of the more intricate techniques in PCNL involves accessing the upper calyx using an inferior calyx entry. This particular maneuver can be successfully executed when the patient is in the prone position.<sup>27</sup>

PCNL is recognized as an effective and safe treatment modality for large kidney stones. Although the efficacy of the procedure has been proven, complication rates exhibit a wide range of complication rates, spanning from 20% to 83%.<sup>28</sup> In the extensive CROES global study, an overall complication rate of 21.5% was reported. These complications could be categorized into different grades, with low-grade cases (grade I and II) making up 16.4% of the total, grade III-a and III-b complications found in 3.6% of patients, and grade IV complications noted in 0.5% of the study participants.<sup>17</sup>

Sumit Kumar et al. observed that the distribution of complications across the pediatric, adult and geriatric cohorts are similar with minor

complications accounting for 85.7%, 86.6% and 86.7% respectively.<sup>18</sup> Among geriatric patients, 15 (15/67; 22.4%) had complications with Clavien I and II constituting 86.7% (13/15) of them. The presence of hydronephrosis (58.3% vs. 18.2% without hydronephrosis;  $p=0.008$ ) and prolonged OT ( $88.82\pm31.35$  min vs.  $73.10\pm20.80$  min in patients without complications;  $p<0.0001$ ) were significant predictors of complications. Sahin et al. retrospectively compared the outcomes of 27 elderly patients of PCNL with 166 younger patients and reported similar stone-free rate, complications and length of stay between them.<sup>29</sup> In our case, the patient showed only mild pain of Visual Analogue Scale (VAS) 2-3, thus, discharged during day 3<sup>rd</sup>, in good condition.

While the study suggests that single-session bilateral PCNL can be safe and effective for the treatment of horseshoe kidney with bilateral staghorn stones in geriatric patients, several limitations and potential drawbacks should be considered. These may include the lack of long-term follow-up data to assess the durability of the treatment, potential complications associated with the simultaneous procedure on both kidneys and the need to carefully select suitable candidates for this approach, given the unique anatomical challenges of the horseshoe kidney. Additionally, the study's generalizability may be limited due to the specific patient population studied, and potential biases, such as those related to data collection and patient selection, should be acknowledged when interpreting the results.

## CONCLUSION

The management of bilateral kidney stone safely remains a challenge for the urologist. The feasibility of single-session bilateral PCNL in the prone position has been described in the recent literature, it is a safe and efficacious treatment option, with similar complication rates than PCNL in a staged manner.

Based on our experience, single-session bilateral PCNL is safe and effective for HSK with bilateral staghorn stones, even for patients with several comorbidities. It is safe because there was no significant complaint as well as no blood transfusion needed and well-maintained kidney function postoperatively. This procedure is also effective due to relatively short time duration with no residual stones.

More publications are needed, either case reports or other prospective studies, to conclude whether bilateral PCNL in a single or simultaneous session is safe and effective in HSK with bilateral staghorn stones.

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