Original Article

Assessment of lower calyceal single-access percutaneous nephrolithotomy for staghorn stones: A single-surgeon and a single-center experience at KAMC, Riyadh

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Abstract

Introduction: Percutaneous nephrolithotomy (PCNL) is still the mainstay and the treatment of choice for most complex renal stones. The success of PCNL is defined by achieving a stone-free rate (SFR). Lower calyceal access PCNL is established to be the safest percutaneous access to the renal system, but controversy is present when it comes to SFR in comparison to upper calyceal and middle calyceal accesses.

Aim: We aim to prove that lower calyceal access PCNL is the safest PCNL access and has the same efficacy as upper calyceal access PCNL for staghorn stones.

Methodology: All lower calyceal access PCNLs done from May 2012 to August 2017 were included in the study. Postoperative complications were reported using the modified Clavien Grading System.

Results: Sixty-seven patients were included in the study. The mean age was found to be 49.39 years; most (36 [53.73%]) patients were male. The prevalence of diabetes, hypertension, dyslipidemia, and chronic kidney disease was 40.91%, 47.76%, 37.31%, and 20.00%, respectively. The mean hospital stay was 7.9 days; mean operative time was 138.52 min. The mean staghorn stone burden was 476.34 mm^2. About 80.59% ($n = 54$) of patients had complete stone resolution after the first session. Only 3 (4.47%) patients had complications and classified as Grade 2 on the modified Clavien Grading System and the remainder were classified as Grade 1, two patients needed postoperative blood transfusion, and one had a renal pelvis perforation.

Conclusion: When it comes to safety and efficacy, the use of lower calyceal single-access PCNL has a very low complication rate compared to upper calyceal access PCNL, especially pneumothorax and bleeding.

Keywords: Lithotripsy, percutaneous nephrolithotomy, renal stone

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INTRODUCTION

Urinary stones are very common worldwide, affecting around 5%–10% of the world's population,[1] among which 15%–20% will require an invasive intervention.[2] Thus, treatment selection is crucial in such a widespread disease. The main objective in urinary stone disease management is to use a modality that is least invasive, morbid, and highly effective.[3,4]

Percutaneous nephrolithotomy (PCNL) is still the mainstay and the treatment of choice for most complex

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renal stones.[4-6] While the success of PCNL is defined by achieving a stone-free rate (SFR), the success of different types of PCNL ranges from 56% to 98%.[7-11] Lower calyceal access PCNL is established to be the safest percutaneous access to the renal system,[5] but controversy is present when it comes to SFR in comparison to upper calyceal and middle calyceal accesses.

Complex renal stones are described as a stone burden >3 cm, where stone burden is measured using the nephrolithometric normogram.[12] We aim to evaluate the lower calyceal PCNL from two aspects. First, by SFR which is defined as invisible stone fragments or stone fragments that are <4 mm in size. Second, by complications as a less morbid procedure is crucial to the advancement of complex stone disease treatment. We will be using the modified Clavien Grading System to grade postoperative complications of lower calyceal access PCNL; we will also report the need of transfusion postoperatively, sepsis, operative time, hospital stay, number of sessions needed to achieve SFR, and pulmonary embolism as single important variables in lower calyceal access PCNL.

With increasing number of clinical trials using upper calyceal access PCNL to establish its efficacy, and the current controversy regarding efficacy of lower calyceal access PCNL our hypothesis is that lower calyceal access PCNL is the safest PCNL access, and has the same efficacy as upper calyceal access PCNL.

METHODOLOGY

This is a single surgeon and single tertiary center retrospective study and was conducted in King Abdulaziz Medical City in National Guard. We aimed to evaluate the efficacy and safety of lower calyceal single-access PCNL for the management of complex renal stones. All patients who underwent lower calyceal access PCNL for stones ≥300 mm^2 from June 2012 to August 2017 were included in the study. Patients with anatomical abnormalities like horseshoe kidney were excluded from the study. An electronic chart review was done for patients with electronic records, whereas paper charts were reviewed for patients with nonexistent electronic files. All patients had a computed tomography (CT) scan and the stone burden was calculated using the nephrolithometric normogram[12] formula (Stone burden = 0.785 × Length $_{max}$ × Width $_{max}$) by an experienced urologist consultant. To assess the SFR of lower calyceal access PCNL, a postoperative CT scan was also reviewed by the same consultant to determine SFR which was defined as invisible stone fragments or stone fragments that are <4 mm in size. For complications, postoperative complications were reported using the modified Clavien Grading System, which has five grades of postoperative complications. Other variables were reported separately such as the need for blood transfusion, operative time, hospital stay, number of PCNL sessions, and pulmonary embolism. Descriptive analysis was done using SPSS software for calculating means and measuring frequencies.

RESULTS

Number of patients included in our study is 67 patients. The mean age was found to be 49.39 years, and most patients were males 53.73% (n = 36) [Table 1]. The prevalence of diabetes, hypertension, dyslipidemia, and chronic kidney disease was 40.91%, 47.76%, 37.31%, and 20.00%, respectively [Table 2]. The mean hospital stay was 7.9 days; mean operative time was 138.52 min. The mean staghorn stone burden was 476.34 mm^2. About 80.59% (n = 54) of patients had complete stone resolution after the first session. About 8.95% (n = 6) of patients required a second session to achieve complete resolution of staghorn stone [Table 3]. Only three patients (4.47%) had complications and classified as Grade 2 on the modified Clavien Grading System; the remainder were classified as Grade 1, two patients needed postoperative blood transfusion, one had a renal pelvis perforation, and none had sepsis or a pulmonary embolism.

DISCUSSION

PCNL is the modality of choice for renal calculi in patients with high stone burden, radiolucent stones, and anatomical abnormalities.[13] Of the different options to deal with renal stones, PCNL bears great rates of success and limited complications. The principle of PCNL is accessing the stone by forming a tract between the skin and calyces.[14] According to the American Urological Association and the European Association of Urology guidelines, PCNL is the gold standard for staghorn stones, any renal stones larger than 20 mm, and lower calyx stones.[4,15]

Proper stone approach is key to ensure complete stone resolution. Optimal access is to produce a short and direct access to stones with minimal complications; upper calyceal access carries the risk of potential thoracic complication. Therefore, PCNL approach affects results.[16,17]

We analyzed all lower calyceal access PCNLs in a single tertiary hospital and revealed that 80.59% of patients had complete resolution of stones after the first session. Moreover, 8.95% needed a second PCNL session. Postoperative complications were very minimal where only three patients had Clavien grade of 2, blood transfusion

Table 1: The demographics and of our population

Characteristic	overall
Age at first OR, mean±SD	49.39±16.56
Gender, *n* (%)	
Female	31 (46.27)
Male	36 (53.73)

SD: Standard deviation, OR: Odds ratio

Table 2: Frequency of comorbidities among our population

Comorbidities	*n* (%)
DM	27 (40.91)
HTN	32 (47.76)
DLP	25 (37.31)
CKD	13 (20.00)
Cystinuria	5 (7.46)
Stone former	11 (16.42

DM: Diabetes mellitus, HTN: Hypertension, DLP: Dyslipidemia, CKD: Chronic kidney disease

Table 3: The mean and standard deviation for hospital stay, odds ratio time, total stone burden at the first site, and stone resolution after the first and second session

Characteristic	overall
Mean stone burden	476.34 mm^2
Mean operative time	138.52 min
Mean hospital stay	7.9 days
Stone resolution after one session	80.59% (*n*=54)
Stone resolution after two sessions	8.95% (*n*=6)

was needed in two patients, and one had a renal pelvis perforation.

We found that the overall SFR after a single session was 80.59%. This is higher than that reported by Singla *et al*., Shalaby *et al*., and Falahatkar *et al*. at 62.2%, 74.8%, and 76.2%, respectively,[18-20] and lower than that reported by Tefekli *et al*., 81.6%.[5] Two studies published in 2017 showed identical results regarding stone resolution rates (92%), which is significantly higher when compared to our result. They compared the outcome between PCNL versus retrograde intrarenal surgery and PCNL as an outpatient procedure versus inpatient PCNL.[21,23] In addition, Sohail *et al*. compared PCNL in both supine and prone positions and revealed consistent results with our data in terms of operative time (130 min).[23]

Our results are similar to Shin *et al*.'s who noted that most of their patients were males and had a mean operative time of 132 min.[24] Likewise, another study that evaluated the lower calyceal approach in PCNL showed similar male gender dominance over females.[25]

Unlike most studies in the literature, our data report low postoperative complication rates. Netto *et al*. stated a 21% complication rate.[26] Falahatkar *et al*. reported 14.8% complication rate and Shalaby *et al*. the highest at 34.6%.[19,20] Blood transfusion is common and was required in two patients in our study. Similar to that, Sohail *et al*., Fahmy *et al*., and Fayad *et al*. reported it in two, three, and four patients, respectively.[21-23]

When compared to other studies, the mean hospital stay was much longer in our patients 7.9 days. The mean hospital stay reported by Shalaby *et al*. and Netto *et al*. was 3 days. It was primarily thought to be due to the unavailability of CT scan/operating room slots or the fact that some patients required a second PCNL session.[19,26]

CONCLUSION

When it comes to safety and efficacy, the use of lower calyceal single-access PCNL has a very low complication rate and is as effective as upper calyceal access PCNL, especially pneumothorax and bleeding. Since this is a retrospective study which carries its own limitations with the design, this opens up an opportunity for future prospective studies. In addition, future studies should include more centers and more surgeon's experiences with a larger sample size.

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Conflicts of interest
There are no conflicts of interest.

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