

# Mini percutaneous nephrolithotomy treat the large upper ureteric stone

*By Haidar Hazim Mohammed Al Jabban*

## **Mini percutaneous nephrolithotomy treat the large upper ureteric stone**

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## Abstract

**Background.** The incidence of kidney stones has been raised overall the world. Nephrolithiasis is a most common cause of illnesses in western countries and has been rising in its incidence in developing countries. PCNL describe for the management of large renal calculi when measure more >20 mm and even for smaller one of lower pole with excellent stone-free rate reach to 98%.

**Aim.** To evaluate the mini-percutaneous nephrolithotomy (mini-PCNL) safety used to cure upper ureteral and renal stones with assess the complication and procedure outcome in Iraqi patients.

**Method.** This a prospective study done between October 2022 and September 2023 in Ghazi Al-Hariri for Surgical Specialties Hospital, Medical city, with enrolled 100 patients who underwent mini-PCNL. All patients had upper ureteral and renal stones (size  $\geq 20$  mm). The nephroscope tube was utilized. The stones were destroyed by pneumatic lithotripter. Complications and outcomes were determined immediately postoperative via X-ray of the ureters, kidneys and bladder. Ultra-sono-graphy also used to determined safety and efficacy of procedure.

**Results.** The cases mean age was  $55.8 \pm 12.3$  years, and their BMI was  $29.5 \pm 5.9$  kg/m<sup>2</sup>. The size of mean stone was  $22.5 \pm 17.9$  mm. The stone-free rate (SFR) was 94.7%. The post-operative hospital stay mean was  $3.6 \pm 2.7$  days. The Hb drop mean was  $0.6 \pm 0.3$  g/dL. There were none of our cases had organs trauma or any complications. Thirty cases required additional subsequent extra-corporeal shock wave lithotripsy.

**Conclusion.** The mini-PCNL is being to be effective and safe, in cases of upper ureteral and renal stones  $\geq 20$  mm. Researches with a larger multi-center cohorts may be needed to validate these techniques.

**Keywords:** Renal stone, Ureteric stone, PCNL, Nephrolithiasis, mini-percutaneous nephrolithotomy

## Introduction

Globally, urolithiasis is one of a common public health problems. The prevalence rates of urolithiasis is more than 10% [1]. The majority of kidney stones are remain asymptomatic, and the management is performed to prevent complications as severe colic, urinary tract infections and renal function impairment [2].

Surgically speaking, kidney stones treatment is a complex approaches due to several competitive management modalities are available and more >1 modality may be appropriate. When, a selection of ideal factors, stay the common significant predictor of better prognosis. The elimination for kidney stones should getting both great SFRs and low rates of complications [3].

The extra-corporeal-shock-wave-lithotripsy (ESWL) and flexible uretero-reno-scopy (URS) are the common management options for kidney stones of less than 20 mm [4].

The AUA guides used per-cutaneous nephron-lithotomy (PCNL) as the first-line managing for cases with a large renal stone [5], due to greater SFR than SWL or URS and is fewer invasive than open surgery or laparo-scopic/robotic-assisted techniques [3].

When complex or large stones present, management procedures that can get completing SFRs with low morbidity and fewer procedures number are ideal, which is open nephron-lithotomy, that evolved into PCNL or retro-grade-intra-renal surgery (RIRS) [6].

PCNL is the gold standard procedure for bigger kidney stones due to the greater SFR and the safely performed by well-trained urologists within short period [7,8]. Commonly, the term “mini-PCNL” is referred to the accessing sheaths < 20 Fr [9].

The drainage and stent-tube pain is one of the commonest symptom among cases, therefore, modern procedures have started to re-explore the ideas of PCNL without the standard nephrostomy drainages [3]. Tubeless PCNL refer to internal drainages with the utilizing of a ureteral stents without the nephrostomy tube placement post-operative. It is safe and efficient approach [3].

Bellman et al. is firstly recorded PCNL without a nephrostomy tubes after the procedures in 1997, tubeless PCNL had been extensively evaluated [10]. Shah et al. had compared the outcome of tubeless PCNL with those of small-bore nephrostomy drainages post PCNL and documented that cases undergoing tubeless PCNL experienced low post-operative complication and were discharged 9 hours earlier [11].

In 2010, Agrawal and Agrawal concluded that tubeless PCNL had favorable outcome in cases with stones of <30 mm [12], to decline the illnesses related to the utilize of larger tools and nephrostomy tubes like hemorrhage, post-operative pain and potential damages, as a result a mini-PCNL combine with tubeless techniques developed [3].

The study purposed <sup>1</sup> to assess the safety of mini-percutaneous nephrolithotomy (miniPCNL) used <sup>18</sup> to treat renal and upper ureteral stones and to evaluate the complication and outcome of these procedures in Iraqi patients.

## <sup>12</sup> Methods

### Study design and setting

<sup>7</sup> This a cross-sectional study (prospective) conducted between October 2022 and September 2023 in Ghazi Al-Hariri for Surgical Specialties Hospital, Medical City, which enrolled 100 cases who underwent mini-PCNL. All cases had upper ureteral and renal stones (size  $\geq 20$  mm).

### Data collection

These included age, sex, BMI, stone size, <sup>17</sup> stone-free rate (SFR), postoperative hospital stay, hemoglobin drop and any complications.

### Exclusion criteria

Cases with congenital anomalies, pyonephrosis and kidney dysfunction or coagulopathies.

### Preoperative preparation

All cases were assessed:

- Medical and surgical histories.
- Physical examinations.
- Laboratory investigations: (GUE, RBS, CBC, PT, PPT, INR, ALT, AST, LDH, bilirubin and creatinine).
- Urine culture and sensitivity.
- CT scan and/ or IVU.

### <sup>5</sup> Stone size formula

“(length  $\times$  width  $\times \pi \times 0.25$ )”

### Stone-free rate (SFR)

SFR is define as the absence of any residual fragments one month after operation.

### Preoperative

- Administer of 3rd-generation cephalosporin namely.
- Anesthesia induction.

### Tools

- Operating nephroscope tube
- Pneumatic lithotripter
- <sup>15</sup> 6-Fr ureteric catheter
- Cystoscopy

- The pelvi-calyceal system
- Fluoroscopy
- 30-Fr and 24-Fr tracts

#### Mini-PCNL procedure

- The tract is dilated slowly with fascial dilators (Cook Urological, UK).
- 24-Fr sheath inserted.
- Apply of semi-rigid nephroscope (18 Fr) (Richard Wolf; Deutschland).
- Employed of automated irrigation pump (MMC Guangzhou; PRC).
- Pneumatic lithotripsy.

#### S-PCNL technique

- Apply “telescopic metal Alken dilators for dilation.
- 30-Fr Amplatz sheath is inserted.
- The standard 24-Fr nephroscope used (Karl Storz, American)
- Pneumatic lithotripsy.

#### Postoperative period and follow-up

The complications and outcomes were determined immediately postoperative via X-ray of the kidneys, bladder and ureters. Ultra-sono-graphy also used to determined safety and efficacy of procedure. Nephroscopy used to check the clearance of calculi postoperation in the both groups. Cases were discharged post nephrostomy tube removal. For all cases, follow-up with abdominal US in the 1<sup>st</sup> day and 30<sup>th</sup> day after.

#### Statistics

Statistical Package of Social Science Software program (SPSS), version 20 was used. Mean, SD, percent and number for data description were used.

#### Results

Table (1) showed the baseline stone and patient characteristics. The mean age was (55.8 ± 12.3 years), and the mean BMI was (29.5 ± 5.9 kg/m<sup>2</sup>). The mean size of stone was (22.5 ± 17.9 mm). Males to females ratio was 3:1 (75 males and 25 females). Right stone found in 44% whereas left stone in 56% of cases. Multiple stone sites was the common presentation (55, 55%) followed by upper calyceal stone (35, 35%).

In relation to cases operative and postoperative variables, the SFR was (94.7%). The post-operative hospital stay mean was (3.6±2.7days). Thirty cases required additional subsequent extracorporeal shock wave lithotripsy. The mean hemoglobin drop was (0.6 ± 0.3 g/dL). The mean operative time was (1.2±0.5 hours), (Table 2).

No organs trauma or complications recorded. Out of 100, 22 cases complained of UTI and six cases need blood transfusion, (Table 3).

**Table 1. Baseline patient and stone variables**

Variables		Mean $\pm$ SD / No.	%
Age (years)		55.8 $\pm$ 12.3	-
Sex	Male	75	75
	Female	25	25
BMI (kg/m <sup>2</sup> )		29.5 $\pm$ 5.9	-
Stone size (mm)		22.5 $\pm$ 17.9	-
Laterality	Right	44	44
	Left	56	56
Site	Upper calyceal	35	35
	Upper ureteral	10	10
	Multiple	55	55

BMI: Body mass index, SD: Standard deviation

**Table 2. The patients operative and postoperative variables**

Variables	Mean $\pm$ SD / No.	%
SFR (%)	-	94.7
Hospital admission (days)	3.6 $\pm$ 2.7	-
Hb dropping (g/dL)	0.6 $\pm$ 0.3	-
Operative time (hours)	1.2 $\pm$ 0.5	-
Subsequent extracorporeal shock	30	30

SFR: stone free rate, SD: Standard deviation

**Table 3. The complications**

Complications	No.	%
Urinary tract infection	22	22
Blood transfusion	6	6
Pneumothorax	0	-
Sepsis	0	-
Trauma	0	-

## Discussion

A high SFR can be achieved from per-cutaneous accesses to the collecting system. It is considered the management of choice for stones (>2 cm diameter) [13]. Generally, for more safety and efficacy of PCNL procedure, when it is done or performed by experienced urologists [14].

When use the conventional PCNL, the renal access with 24–34 Fr (diameter) is necessary. While a reducing the diameter of an access sheaths lead to the mini-PCNL technique utilize [15], however, when use mini-PCNL, the diameter can decline hemorrhage and rate of transfusion [16].

The benefits of mini-PCNL are reduce the morbidity, one-step dilatation techniques, small-bore accesses (18-Fr), continuous low-pressure irrigation by facilitate rapid stone retrieval without stone forceps (baskets) using, directed the access closure without a nephrostomy tube placement, feasibility, safety, efficacy in the small renal and lower calyceal calculi management, lead to completely stone clearance in (92.9%) (stones of <2 cm), its efficacy with larger stones [13].

The main nephrostomy tube complication is postoperative pain and to minimized the modifications, include the tubeless PCNL utilized, must be documented [15]. The advantages of tubeless PCNL are reduced postoperative discomfort, pain and decreased requirement of analgesics [17].

Here, the stone size mean ( $22.5 \pm 17.9$  mm) was greater than that in previous works [10-16], assuming that stone clearances are not affected by the small diameters of the access tracts. Stone retrieval utilizing the vacuum cleaner effecting of continuous low-pressure irrigations without the needed for endoscopic manipulations with stone graspers might contributed to an effective stoned clearance and accelerating the procedures [18].

The mean operative time in this work was  $1.2 \pm 0.5$  hours. Information about whether miniaturization of the access sheaths causing the longer time of operations in cases with larger stones are contrast. A study of 180 cases who underwent either conventional or mini-PCNL had documented that mini-PCNL has significantly longer operative times for simple stones (89.4 versus 77.0 minutes), stag-horn stones (134.3 versus 118.9 minutes) and multiple stones (113.9 versus 101.2 minutes) [19]. In fact, in a previous prospective trail between two procedures in 50 cases, Knoll et al. recorded no difference in terms of the time between cases who underwent surgical intervention in which an 18Fr access sheaths, rather than a 26Fr access sheaths, was utilized [16].

Many factors that lead to reduced mini-PCNL operative time, are the one-step dilatation of the access tracts and the vacuum cleaner effected the facilitate stones retrieval without the needed of stones graspers [15].

Because this study was prospective in nature, no organs traumas or complications recorded. Out of 100, 22 cases complained of UTI and six cases need blood transfusion assessed. However, no cases had complications, similarly with previous works [11,13-18].



A significant blood loss is the major concern of PCNL which requiring blood transfusion (BT). In the current work, the mean Hb dropping level was  $0.6 \pm 0.3$  g/dL; six cases required a BT and all cases were treated conservatively by IVFs.

The achievement of low transfusion rate in mini-PCNL attributed to few parenchymal traumas and declined trauma risks in larger segmental vessels with the utilize of a small-bore dilators during the establishment of the access tracts. The lowered transfusion rates reported in previous works [15].

The stone sizes identified as a delimitating factors for the succeeding of PCNL management [15]. However, in our study the mean size was ( $22.5 \pm 17.9$  mm).

Few researches done for making a comparison between the standard PCNL and miniPCNL [20]. A lot of works were enrolling a small participants number [21], applied several lithotripsy protocols in both arms [22], had conducted various sizes of stones [23], positions [16], or complexities [24]. Moreover, we believing that tubeless mini-PCNLs are a unique and better options that used safely.

### Conclusion

The mini-PCNL is safe and effective, in the cases with upper ureteral and renal stones  $\geq 20$  mm. It is more effective in cases with larger renal stones. The SFR observe to be high in mini- PCNL. The mini- PCNL does not tending to be a long operative times and severe complication. Studies with a larger multi-center cohorts may be needed to validating these techniques.

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### Conflicts of interest

None.

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