

# TREATMENT OF LARGE IMPACTED UPPER URETERIC STONES WITH MINI-PERCUTANEOUS NEPHROLITHOTOMY (PCNL) BY ADAPTING MIDDLE CALYX APPROACH: A SINGLE CENTRE STUDY

Muhammad Izhar<sup>1</sup>, Riaz Ahmad Khan<sup>1</sup>, Muhammad Asad shamsher<sup>1</sup>, Irfan Ullah Khan<sup>1</sup>, Zahid Ullah khan<sup>1</sup>, Qaiser Iqbal<sup>1</sup>, Israr ul Haq<sup>1</sup>, Bakhtawar Gul<sup>1</sup>, Aslam Khan<sup>1</sup>

<sup>1</sup> Institute of Kidney Diseases, Peshawar, Pakistan

## ABSTRACT

**Objective:** To evaluate the role of mini-Percutaneous Nephrolithotomy through the middle calyx approach for the treatment of impacted upper ureteric calculi.

**Materials and Methods:** This descriptive cross-sectional study was conducted between 1st August 2019 and 31st July, 2020 in which 50 patients underwent mini-PCNL through middle calyx approach using 18-Fr access sheath for impacted upper ureteric stones. Patients of either gender with impacted upper ureteric stones  $\geq 15$  mm were included in the study. Patients with abnormal coagulopathy state, active urinary tract infection, pregnant ladies, and abnormal upper urinary tract anatomy were excluded from the study. Post-operatively patients were evaluated radiologically. After 2 months IVU of the patients was done followed by a renal scan.

**Results:** Ninety-six percent(48) of patients have complete clearance through a single tract. However, the stone fragments remained in the pelvicalyceal system were the residual stones floated back into the system during the whorl pool mechanism. The mean age of the patient was  $34.9 \pm 12.6$  years. One patient had ureteral perforation. Supra twelfth puncture was done in forty-two while in 8 patients puncture below twelfth rib was carried out. Pneumothorax occurred in one patient due to a very highly located kidney. Two patients went into sepsis. No mortality was noted. The stone-clearance rate was established as 96%.

**Conclusion:** The impacted upper ureteric calculi ( $\geq 15$ mm) can be managed with minimally invasive techniques such as mini-PCNL by adapting the middle calyx approach using an 18-Fr access sheath. Moreover, this approach is effective with a greater stone-free rate.

**Keywords:** Ureteric stone, lithotripsy, Renal calculi, Kidney, Urolithiasis, endourology

## INTRODUCTION

There are many surgical options for the management of impacted upper ureteric stones. The durations as well as the degree to which the calculus is impacted result in renal function derangement. Surgical options include Extracorporeal shockwave lithotripsy(ESWL), PCNL, open and laparoscopic surgeries.<sup>1</sup> Impacted stones cannot be treated well

with ESWL and will need auxiliary procedures.<sup>2</sup> The impacted upper ureteric stones cannot be bypassed by a ureteric catheter or guidewire.<sup>3-4</sup> With the recent advancement in minimally invasive procedures the mortality and morbidity have been significantly reduced. PCNL is a safe and effective procedure with fewer complications rates in the management of impacted upper ureteric stones.<sup>5</sup> It has a better stones clearance rate for ureteric stones  $\geq 15$  mm and renal stones could be managed simultaneously. In contrast, URS has shorter hospital stay and operative time.<sup>6</sup> The current study describes our experience with mini-PCNL by adapting the middle calyx approach for impacted upper ureteric stones.

### Correspondence:

Riaz Ahmad Khan

Assistan Professor, Institute of Kidney Diseases, Peshawar, Pakistan

Email: riaz286@yahoo.com

Contact: +923365449235

## MATERIALS AND METHODS

This descriptive cross-sectional study was conducted between 1<sup>st</sup> August 2019 and 31<sup>st</sup> July 2020, 50 patients underwent a mini-PCNL through middle calyx approach using an 18-Fr access sheath for impacted upper ureteric stones after taking approval of the institutional ethical committee. Pneumatic lithoclast was used to fragment the stones. Patients of either gender with impacted upper ureteric stones  $\geq 15$  mm (no contrast seen below the filling defect on IVU ) were included in the study. Patients with abnormal coagulopathy state (increased PT& APTT), active urinary tract infection ( presence of pus cells on urine routine examination), pregnant ladies, and abnormal upper urinary tract anatomy such as ectopic kidney, horseshoe kidney, and retrocaval ureter were excluded from the study. The mean age of the patient was 35.5 (21–64) years.

Since in mini PCNL, approach to the pelvicalyceal system by adapting upper and lower calyces have limited access to the rest of calyces so there are more chances of residual stones when the stone is pushed back. However, the researchers made an approach to the renal system through middle calyx which showed liberty to access the upper ureter and the whole pelvicalyceal system in the majority of cases. Post-operatively patients were evaluated radiologically by performing X-ray KUB and Ultrasound KUB. After 2 months intravenous urography(IVU) of the patients was done followed by the renal scan for patients with suspected ureteric stricture on IVU.

The whole procedure was done under general anesthesia. Single-dose of antibiotics is given to all patients pre-operatively. The ureteric catheter is passed but not beyond the impacted stone as the stone couldn't be bypassed. The Pelvicalyceal system is opacified by performing retrograde pyelography. However, in the cases in which the system couldn't be opacified, puncture is done and contrast is injected to opacify the system for middle calyceal puncture. The tract is secured by passing a guidewire through the needle. Access to the system through middle calyx is achieved percutaneously by a needle under fluoroscopic guidance. Dilatation of the tract was done up to 18 Fr with a single-step metallic dilator and a 12-Fr-sized miniature nephroscope was used. The stones were broken into pieces by pneumatic lithoclast and small fragments were retrieved using

a whirlpool mechanism. A double J stent was passed in all patients. In some of the cases, an appropriate nephrostomy catheter (18Fr) was placed at the end of the procedures.

## RESULTS

Ninety-six percent(48) of patients have complete clearance through a single tract. However the stone fragments remained in the pelvicalyceal system were the residual stones floated back into the system during the whirl pool mechanism. The mean age of the patient was  $34.9 \pm 12.6$  years. The treatment procedure of Mini-PCNL by adapting the middle calyx approach was considered successful when the patient was stone-free or had residual stone fragments  $\leq 5$  mm. One patient had ureteral perforation during fragmentation which was stented successfully. Supra twelfth puncture was done in forty-two while in 8 patients puncture below twelfth rib was done. Pneumothorax occurred in one patient due to a very highly located kidney. Two patients went into sepsis. No mortality was noted. DJS removal was done after 2 weeks except in one patient with ureteric perforation in which the stent remained in situ for 6 weeks. Further, the stone-free rate (SFR) is established as 96% suggesting mini-PCNL though middle calyx approach is a feasible technique for impacted upper ureteric stones ( $\geq 15$  mm).

## DISCUSSION

Urolithiasis is one of the major problems in Pakistan. It may not only cause recurrent urinary tract infection but may also cause obstructive uropathy which ultimately leads to loss of one or both kidneys.<sup>7</sup> American Urological Association specified that for the treatment of proximal-ureteral stones  $<1$  cm, Shock Wave Lithotripsy, ureteroscopy, and PCNL are all adequate decisions;<sup>1</sup> however, ureteroscopy may become less appropriate as the calculi encountered become larger. The stone clearance rate is also highly affected by the ureteral wall thickness.<sup>8</sup> The selection of proper treatment options for large impacted upper ureteral calculi remains controversial, especially at those institutions where limited resources are available.<sup>9-11</sup> EAU guidelines recommend PCNL as management of choice for large impacted proximal ureteral stones.<sup>12</sup> In comparison to other procedures, PCNL has greater stone clearance with less operative time.<sup>13</sup> Further, complete stone clearance can be achieved through PCNL, however

Table 1: ?

Site of puncture	Number of patients
Supra 12th	42
Below 12th	8
Complications	Number of patients
Pneumothorax	1
Sepsis	2
Ureteric perforation	1

laparoscopic ureterolithotomy has been successful in patients with large size stones.<sup>14</sup> In a study done by Lijie et al. PCNL and Ureterolithotripsy (URS) were compared for upper ureteric stones over 15 mm size, favored PCNL with low residual stone rate, and high stone clearance rate. However, the loss of Haemoglobin was greater in PCNL.<sup>15</sup> Comparative evaluation of antegrade versus retrograde ureterolithotripsy for impacted upper ureteric calculi showed complete stone clearance in all cases in the antegrade approach while the retrograde approach was successful in 55 % of cases.<sup>16</sup> Initially stone clearance rate was 93.3 % in the mini PCNL group as compared to 41.4 % in the URS group.<sup>17</sup> The stone clearance rate was 100 % in PCNL, 90.5 % in Laparoscopic ureterolithotomy, and 77.3% in retrograde Ureterolithotripsy. In some cases, a combined effort of ureteral push back and percutaneous retrieval was performed.<sup>18</sup> A study conducted by Teichman et al noticed 87% stone clearance by ureteroscopy and 100% at the end of 3 months for impacted calculi < 15 mm. The mean operative time was 108 ± 27 minutes.<sup>19</sup> In the current series complete clearance of the impacted upper ureteric stones is achieved in ninety-two percent of cases within one single session with no ancillary procedure required. Identifying the stone impaction may also help in the selection of an appropriate treatment modality. The clinical implication of the study is that the nephroscopic manipulation is easy and has access to all the calyces where stones fragments are floated and chocked during fragmentation. Further while removing the urethral catheter normal saline is injected through the ureteric catheter so that stones fragments that are left in the ureter may be pushed back to pelvicalyceal where it can be retrieved through a whirlpool mechanism. In this way, the need for ancillary procedures is also limited. None of the patients required more than one tract. Thus Mini-PCNL through the middle calyx

approach is recommended as a valuable and good management option for large impacted upper ureteric stones with less requirement of any auxiliary procedure. Complication of ureteral perforation occurred in one patient which was managed timely by stenting. However, the cases in which urinary diversion procedures were done previously where retrograde access is difficult, the antegrade access is possible and has a greater working place for nephroscopic fragmentation. During the mean follow-up of one year, two patients developed significant ureteric stricture which was managed timely.

## CONCLUSIONS

The impacted upper ureteric calculi ( $\geq 15\text{mm}$ ) can be managed with minimally invasive techniques such as mini-PCNL by adapting the middle calyx approach using an 18-Fr access sheath. Moreover, this approach is effective with a greater stone-free rate.

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