

# MINI PERCUTANEOUS NEPHROLITHOTOMY THROUGH UPPER CALYCEAL PUNCTURE IN PAEDIATRIC AGE PATIENTS; A SINGLE CENTRE EXPERIENCE

Faiz ur Rahman<sup>1</sup>, Tariq Ahmad<sup>2</sup>, Muhammad Izhar<sup>3</sup>, Muhammad Naeem<sup>4</sup>, Riaz Ahmad Khan<sup>5</sup>, Irfanullah Khan<sup>6</sup>

<sup>1-6</sup>Institute of Kidney Diseases, Peshawar - Pakistan.

**Address for correspondence:**  
**Muhammad Izhar**

Institute of Kidney Diseases, Peshawar - Pakistan.

E-mail: izhar.kmc888@gmail.com

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## ABSTRACT

**Objective:** To determine the outcome of Mini Percutaneous Nephrolithotomy through upper calyceal puncture in pediatric age patients.

**Methodology:** This cross-sectional study was conducted at the Department of Urology, Institute of Kidney Diseases, Peshawar from February 2018 to July 2019. A total of 30 children were enrolled using consecutive sampling. They underwent mini-PCNL through upper calyceal puncture for renal stone extraction. The patients were evaluated for different outcome variables. Data was entered in SPSS version 20 and descriptive statistics were calculated for all variables.

**Results:** Out of 30 patients, mean age of the patients was  $11.72 \pm 2$  years with range of 8-16 years. The stones had a mean size of  $13.8 \pm 3$  mm. Maximum Ppatients had single puncture (70%), while remaining (30%) had double puncture entrance. A high stone free rate was achieved (86.6% cases). The mean time for operation was  $53 \pm 15$  minutes. In total, 2 children developed fever and 3 dropped hemoglobin of about 0.8 g/dl.

**Conclusion:** mini-PCNL through upper calyceal puncture is an effective procedure for the management renal calculi in pediatric population. It has high stone free rate, less serious complications and short post-operative hospital stay.

**Key Words:** Mini percutaneous nephrolithotomy, Peadiatrics, Renal calculi

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## INTRODUCTION

Renal stone disease is increasing in children with a prevalence varying from 5% to 15%. Anatomic anomalies, metabolic disturbances, and urinary tract infections are the major predisposing factors for renal stone disease in pediatric age population<sup>1,2</sup>. Environmental and dietary factors are also considered as other causes for increased incidence of renal stone disease<sup>3</sup>. During the past few years, the treatment modalities of the renal stone disease have changed with the introduction of Extracorporeal Shockwave Lithotripsy (ESWL) which is now considered as the first-line treatment in pediatric age group. Surgical intervention may be considered in some patients having staghorn, cystine or oxalate stones as ESWL has low efficacy in such types of stones<sup>4,5</sup>. Woodside J, et al. introduced Percutaneous Nephrolithotomy for the first time in 1986 which became a good option for the treatment of renal calculi because it is less inva-

sive procedure than open surgery<sup>6</sup>.

Different studies have been conducted for the safety and efficacy of mini-PCNL and now it is considered as the treatment of choice for stones larger than 15 mm in pediatric age group<sup>7-9</sup>. Both in children and adult population, Percutaneous Nephrolithotomy (PCNL) procedure is being performed with maximum safety. One of the biggest challenge in this perspective is to minimize the morbidity related to PCNL. Specialists, now, have more interest towards the mini, micro, tubeless PCNL and ultra-mini-PCNL because of the reduction in the morbidity and mortality rate among the patients<sup>10-13</sup>. Miniaturization of equipment and improvement of surgical technique in the management of pediatric renal stone disease has underwent a dramatic evolution over the past few years<sup>14</sup>. Further, in pediatric age patients, the surgeons by adapting upper calyceal approach have more liberty to reach each and every calyx and even up to proximal ureter which will enable them to achieve

maximum stone clearance with minimal complications. The aim of this study was to determine the outcome of mPCNL through upper calyceal puncture in pediatric age patients

## METHODOLOGY

This study was conducted at the Department of Urology, Institute of Kidney Diseases Hayatabad Peshawar. Thirty patients aged 8-16 years were enrolled with consecutive sampling. All patients were evaluated through laboratory and radiological investigations like X-Ray KUB and intravenous pyelography. CT urogram was also performed in patients having inconclusive Intravenous Urogram (IVU). Antibiotics were given prophylactically before and after the procedure. After setting the protocols, mini Percutaneous Nephrolithotomy (mPCNL) was performed through upper calyceal puncture by consultant urologist having experience in pediatric urology.

The patients were positioned in lithotomy position and a 4.7 Fr ureteric catheter was passed through guide wire in a retrograde fashion up to the pelviureteric junction (PUJ). The tip of the ureteric catheter was confirmed at PUJ level by the fluoroscope. Patients' position was changed to prone and proper cushioning was provided to safeguard the pressure areas. Radiographic contrast was used in retrograde fashion using a ureteric catheter to opacify the pelvicalyceal system. The medial and lateral planes are assessed through c-arm. A guide wire was passed through the needle down the ureter, puncture needle was removed. Rigid alkens dilator (first 12F and then 15F) was used for dilation of the tract to make space for 17 Fr nephroscopic sheath (Figure 1). The procedure was done through a mini nephroscope with 12 Fr gauge. The collecting system was examined by inserting 12 Fr nephroscope (Figure 2) into the sheath (Figure 3).

Isotonic solution was used for continuous irrigation. Laser lithotripsy was used in 18 cases having hard stones while pneumatic lithotripter was used for the remaining 12 cases for fragmentation of stones. Fragments were removed from the collecting system by semi-rigid grasper (4Fr) shown in figure 4 and 5.

At the end of the procedure, fluoroscopy was performed to evaluate the success of the procedure. Ultrasound KUB was done for radiolucent stones. Outcome was measured in terms of stone free rate, decrease in hemoglobin level and post-operative hospital stay. Patients' demographic profiles, procedural details, and outcomes were documented in a structured proforma. All the data was entered in SPSS version 20 and descriptive statistics were calculated.

## RESULTS

Mean age of the patients was  $11.72 \pm 2$  years with age range of 8-16 years. The presence of stones in kidney showed that 6 children had 3 stones, 10 had 2 stones, 7 had 1 stone, while the remaining 7 had multiple stones as shown in table 1.

The pre-operative metabolic workup showed hypercalcemia in majority of children. Three patients reported to have a single staghorn calculus with size ranging from 2.7 cm to 2.9 cm. Mean stone size was recorded to  $13.8 \pm 3$  mm. Maximum had single puncture (70%), while remaining (30%) had double puncture entrance as shown in figure 1.

A high stone free rate was achieved in 26 (86.6%) cases. For treatment of residual stone, three patients were treated through retrograde intra-renal surgery while one was treated with ESWL. The mean time for operation was  $53 \pm 15$  minutes. Two patients developed infection who were managed in with IV antibiotics. The mean postoperative stay was  $\pm 1$  days.

## DISCUSSION

In the current study, we observed 86.6% stone-free rate and mean operative time of  $53 \pm 15$  minutes which is comparable with previous literature<sup>21</sup>. Two patients developed infection and were managed with empirical antibiotics therapy. High stone-free rate, accessibility to the lower pole stones, and short operative time are the main advantages of mPCNL through the upper calyceal puncture. Improvement and modifications in the apparatus will further increase the performance of this

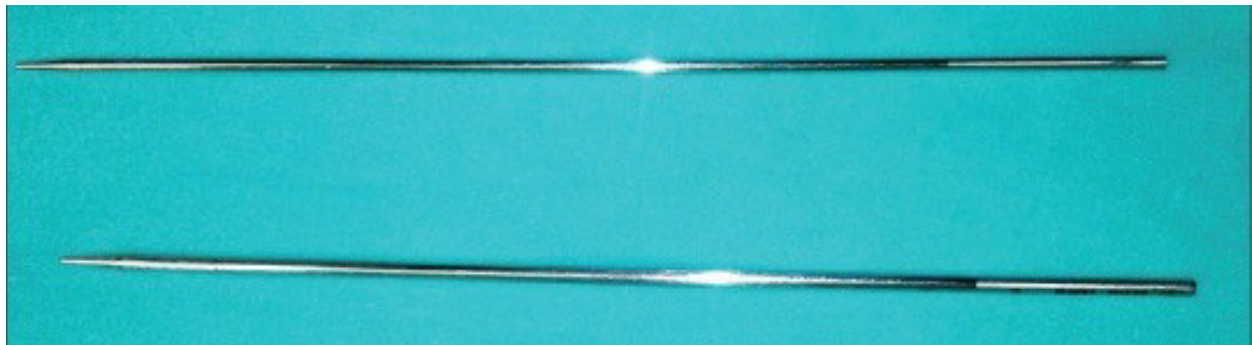


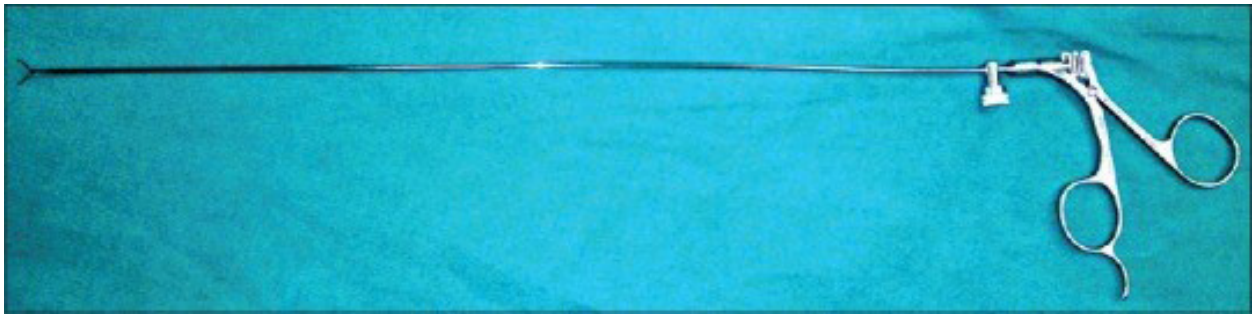
Figure 1: 12F and 15F dilators



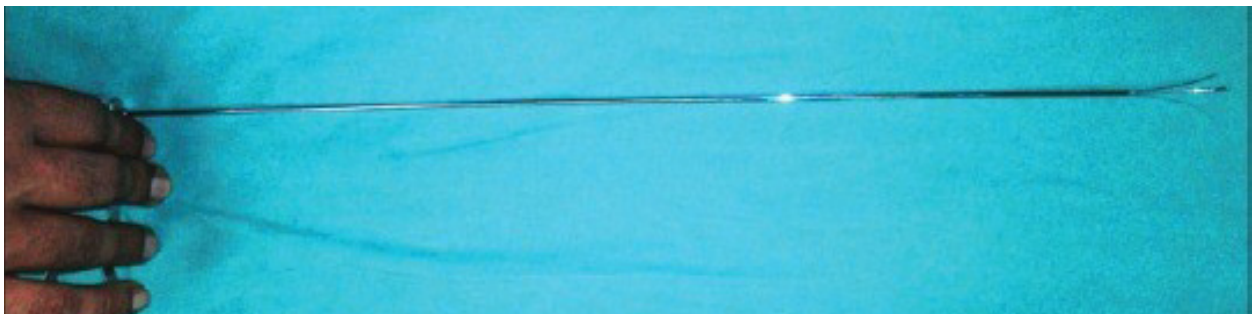
**Figure 2: 12F nephroscope**



**Figure 3: Outer and inner sheath and trocar**



**Figure 4: Two-pronged grasper**



**Figure 5: Three pronged grasper**

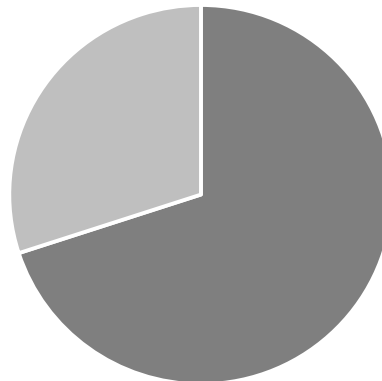
**Table 1: Frequency of stones**

| No. Of Stones   | Number Of Children | Percentage |
|-----------------|--------------------|------------|
| Multiple stones | 7                  | 23.3 %     |
| 3 stones        | 6                  | 20.00 %    |
| 2 stones        | 10                 | 33.4 %     |
| 1 stone         | 7                  | 23.3 %     |

**Table 3: Frequency of outcome measures**

| Outcome                        | Frequency | Percentage |
|--------------------------------|-----------|------------|
| Stone clearance                | 26        | 86.7 %     |
| Residual stones                |           |            |
| Retrograde intra-renal surgery | 3         | 10 %       |
| ESWL                           | 1         | 3.3 %      |

FREQUENCY OF PUNCTURE ENTRANCE



■ Single puncture entrance    ■ Double puncture entrance

procedure by maintaining a high level of efficacy and safety profile.

Mini-PCNL is considered to be the procedure of choice now a days with a higher stone-free rate and low complication rate in children<sup>15</sup>, and an even better option for stones refractory to ESWL<sup>16</sup>. The outcome and complications rate of PCNL is similar to the adult population, while it is used for large stones ( larger than 1.5cm) in children<sup>17</sup>.

Conventional PCNL with large instruments has a greater risk of extensive parenchymal damage, blood loss and other risks and it makes it restricted in children to mPCNL worldwide due to smaller kidneys. The first study was conducted by Jackman, et al.<sup>7</sup> who had developed and used the new technique "mini-perc" with the help of 13Fr. The study had a stone-free rate of 85% in children with a mean age of  $3.4 \pm 0.5$ . Results of different

studies show that mPCNL for the management of renal stones among children is effective and safe with a 70-95% stone-free rate<sup>18</sup>. Mini-PCNL increases the stone-free rate for large pelvic stones while the decrease in mean operative time<sup>19</sup>. This procedure is a good option for kidney stones in pediatric age groups as it offers a high stone-free rate, other surgical outcomes, and minimum complications rate<sup>20</sup>. However, limitations may be the extension of mini PCNL to conventional PCNL in case of large staghorn calculi and bleeding which obscure the vision.

## CONCLUSION

It is concluded that mPCNL through upper calyceal puncture is a better procedure for the management of renal calculi in the pediatric population. The study also concluded a high stone-free rate, less serious complications, and short post-operative hospital stay



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## CONTRIBUTORS

FUR conceived the idea, wrote initial manuscript, TA and MI made the plan, submitted the protocol to research ethics committee and followed the project with regards to data and statistics. MN and RAK helped in acquisition and interpretation of data, literature review, bibliography and writing of final draft of the manuscript. IUK helped in technical corrections, designing the plan, provision of surgical expertise and overall supervision. All authors contributed significantly to the submitted manuscript.