

## Pediatric Percutaneous Nephrolithotomy in a Peripheral Tertiary Care Center in Nepal

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### ABSTRACT

#### Introduction

Pediatric nephrolithiasis though uncommon, poses clinical management dilemma due to anatomical and physiological factors. Percutaneous Nephrolithotomy (PCNL) is well established in adults and miniaturization of the instruments has helped to expand its indication for uses in pediatric population with equivalent results. The aim of our study is to evaluate the application of the procedure in our settings.

#### Methods

This was a retrospective study done at Nepalgunj Medical College teaching hospital from June 2017 to April 2020. Total of 75 patients with 76 renal units under 18 year of age were evaluated. PCNL was done in prone position in all patients using fluoroscopy for initial puncture and subsequently for clearance. The size of the tract varying from 15 Fr to 24 Fr was decided based on the degree of hydronephrosis.

#### Results

Mean stone volume was 372 mm<sup>2</sup>. With mean operative time of 58 min, 96% of stone clearance rate was achieved. Mini PCNL was done in most of the cases. Single tract was used in 84% cases mostly with subcostal puncture. Major complications were pelvic perforation in 4% cases and two patients required restaging.

#### Conclusion

PCNL in pediatric population is safe with good stone free rate with minimal complications. Application of miniaturized instruments has further improved the outcome with comparable morbidity.

**Keywords:** *Mini PCNL, pediatric nephrolithiasis, percutaneous nephrolithotomy, urolithiasis*

## INTRODUCTION

Renal calculus disease in children is uncommon but poses a clinical management dilemma due to small size of the urinary tract.<sup>1</sup> The majority of such children have high risk of recurrence which used to be 16-18% previously but now nears approximately 50% as in their adult counterparts.<sup>2,3</sup> This high recurrence may be owing to environmental and dietary factors, anatomic and metabolic abnormalities and infectious diseases.<sup>4</sup> Making the patient stone free with least possible morbidity using least invasive modality should be the goal while treating such patients.<sup>5,6</sup> Percutaneous nephrolithotomy (PCNL) with different forms of miniaturization has evolved as a modality of choice for various sized stone in pediatric population.<sup>7-9</sup> We present our experience with pediatric PCNL at our institution.

## METHODS

This is a retrospective study done at Nepalgunj Medical College teaching hospital, Nepalgunj. Seventy five patients of less than 18 years age presenting over three years (2017-2020) were included. Patient demographics, indication for surgery and relevant investigations were recorded from patient's charts. Ethical clearance for the study was obtained from Institutional review board. Intravenous urography (IVU) or CT urography (CTU) was done to evaluate the stone characteristics, renal anatomy and other visceral condition. Stone dimension was recorded along its maximum length and breadth as measured with scale in given IVU or CTU and recorded as volume in mm<sup>3</sup>. Urine culture and sensitivity test was done and those children with negative cultures were taken for the procedure.

Procedure was comparable to that done in adults. Under general or spinal anesthesia ureteric catheterization was done using 4-6 Fr catheter. PCNL was done in prone position in all patients. Fluoroscopy was used for initial puncture with Bull's eye technique, and subsequently for clearance. The size of the tract varying from 15 Fr to 24 Fr was decided based on the degree of hydronephrosis. Pneumatic lithotripter was used for stone fragmentation. Decision for placement of ureteric stent and nephrostomy was based on condition of pelviureteric junction, stone clearance and peroperative complication if any. Per operative and post operative complications were recorded. Patient was rendered stone free once it was not visible in plain X-ray KUB done in post operative day 2 and after 6 weeks of follow up.

IBM SPSS (version 20.0) was used for analysis of data. Chi square and Student t-tests were applied where applicable, and p value of < 0.5 was considered significant.

## RESULTS

Seventy five patients with 76 renal units were operated. Mean age of the patient was 14.89 years, the youngest being a 4 year old boy (Figure 1).

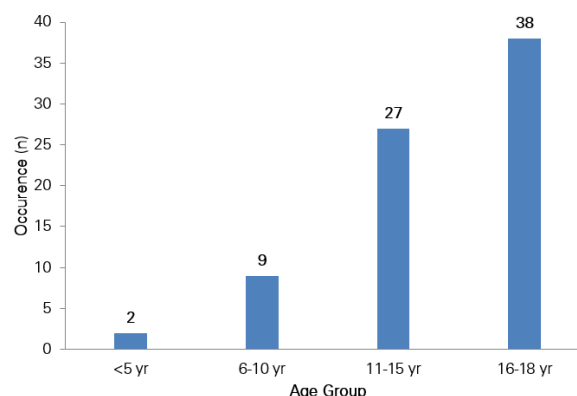


Fig 1. Distribution of renal calculus according to patient age group

Female patients outnumbered (41:34). Most of the patients had stone on right side (43 vs 33) and one had bilateral simultaneous procedure. Mean stone length along its maximum dimension was 2.09 cm (Range:0.5-5 cm) with average volume of 371.89 mm<sup>3</sup>. Most of the patients had presenting complaints of pain (77%) (Table 1).

Most of the patients underwent procedure under spinal anesthesia. Predominantly less than 20Fr tract was used to accomplish the procedure with

Table 1. Patient characteristics

Characteristics	Values
Presenting complaints (%)	
Pain	77
Hematuria	0
Asymptomatic	23
Preoperative	
Hb, mean $\pm$ SD, gm/dl	12.04 $\pm$ 1.46
Creatinine, mean $\pm$ SD, mg/dl	0.89 $\pm$ 0.69
Stone volume (mm <sup>3</sup> ), median (range)	270 (25-2000)
Stone morphology, n (%)	
Staghorn (complete/partial)	20 (26.3)
Non staghorn	56 (73.6)
Stone location, n (%)	
Pelvis	71 (93.4)
Upper calyx	13 (17.1)
Middle calyx	58 (76.3)
Lower calyx	32 (42.1)
Upper ureter	4
Stone number	
Single	42
Multiple	34

Table 2. Perioperative data

Intraoperative parameters	Values
Anesthesia, n (%)	
SAB	63(84.2)
GA	6 (7.9)
Conversion to GA	6 (7.9)
Operation, n	
Mini PCNL	57
Standard PCNL	19
Operation time, min,	
Mean $\pm$ SD	58.6 $\pm$ 29.7
Range	15-120
No. of tracts	
Single	64
Multiple	11
Puncture	
Subcostal	31
Supra12 <sup>th</sup>	29
Supra11 <sup>th</sup>	15
Access	
Upper calyx	31
Middle calyx	21
Lower calyx	13
Multiple calices	11
Tract size (Fr)	
15	28
18	29
24	9
26	10

mean operative time of 58 min. Mostly upper calyx was used for access (40.7%) with multiple tracts requirement in 11 patients (Table 2). Comparing mini PCNL and Standard PCNL revealed similar outcome when stone size and operative time was compared (Table 3).

Table 4. Postoperative outcome data

Intraoperative parameters	Values
Stone free rate, %	96
Nephrostomy duration, days, median	2
Postoperative Hb, mean $\pm$ SD, gm/dl	11.84 $\pm$ 1.46
Complications	
Pain	30
Fever	7
Hematuria (Not requiring embolization)	5
Pelvic perforation requiring conversion	1
Pelvic perforation not requiring staging	2
Blood transfusion	2
Need of Staging, n	2

Stone clearance was achieved in 96% of cases. Two patients had residual calculi which needed repeat settings. One of the patients had large residual fragments which required retrograde procedure for migrated stone to ureter and PCNL for stone in kidney (Table 4).

## DISCUSSION

PCNL was introduced in pediatric population nearly 10 years after successful application in adults in 1976 by Fernstorm.<sup>10,11</sup> Minimally invasive technique has advantage of good outcome with decreased morbidity, higher stone free rate even in complex cases and reoperation with less trauma to kidney. Further miniaturization in the technique over years has led to increasing uses of PCNL in pediatric groups with equivalent results.<sup>12,13</sup>

Our patient group has almost equal gender predominance as seen in other series.<sup>14</sup> Though a significant percentage of patients may be asymptomatic at presentation, pain is the usual feature. Abdominal pain rather than a more localized

Table 3. Comparison of variables in Mini and Standard PCNL

Variables	Mini PCNL	Standard PCNL	p-value
Sex			
Male	26	8	0.79
Female	31	11	
Side			
Right	32	11	0.82
Left	25	8	
Mean age, yr	14.72 $\pm$ 3.7	15.42 $\pm$ 2.6	0.45
Stone size, mm <sup>2</sup>	360.1	407.26	0.57
Mean operative time, min	53.86 $\pm$ 28.5	71.8 $\pm$ 29.4	0.02
Mean hospital stay, days	2.51 $\pm$ 0.78	2.58 $\pm$ 0.69	0.72

flank pain as seen in adults is the usual feature.<sup>7</sup>

Most of the patients in our series received spinal anesthesia while, according to literature, general anesthesia is preferred for PCNL in pediatric patients.<sup>7,8</sup> Nearly 8% patients who were very young or uncooperative had to be taken under general anesthesia. Intravenous anesthesia was added to those who had pain during the procedure. Pediatric PCNL is possible under spinal anesthesia and there are ample of studies mentioning that pediatric spinal blocks are quite safe and even better in few occasions.<sup>15,16</sup>

Miniaturization of the tract size has been a boon especially in pediatric population where degree of dilatation of the peripheral calyx and size of infundibulum is important to be taken into consideration. Several reports mention that any risk of complication is associated with the tract size, modifications to which can decrease morbidity such as bleeding, postoperative pain, and potential renal damage.<sup>17,18</sup> Mini PCNL is same as that of standard PCNL with smaller tract size. Few series are available showing stone clearance rate as much as 80%–93% with fewer complications.<sup>19,20</sup> We had larger number of patients who underwent mini PCNL. This was largely dependent on size of the calyx and infundibulum rather than the size of the stone. Both groups were comparable and clearance rate in both groups were good approaching 96% with similar complication rate.

Access to optimal calyx is vital for desired success in PCNL. Success rate of 58-80.9% could be achieved by accessing lower calyx in many series.<sup>8,21</sup> On the other hand middle calyceal approach led to success rate of 70.8% in few other series.<sup>22</sup> We accessed through upper calyx in most of the cases (40.8%) and through middle calyx and all calices in combination in 27.8% and 14.5% of cases, respectively. Subcostal approach was the mostly used one. It is important as supracostal tract may cause pleural injury in as much as 2 % cases.<sup>23</sup> However, the position of kidney and stone within it and anatomy of the calices is what matters. We didn't encounter any case of pleural injury in our series though nearly 60% was supracostal access with nearly 20% supra11th access. Multiple access was needed in approximately 15% of cases. In complex calculus disease, multiple tracts may be needed with minimal added morbidity.<sup>22,23</sup>

Complications in PCNL may be seen in around 20% cases.<sup>24</sup> In our series pelvic perforation was seen in 4% of the patients as compared to other studies which show nearly 4.7-12% of incidence. One patient required immediate conversion to open surgery and later needed restaging for complete removal of calculus. Two other patients had pelvic perforation that was managed conservatively with DJ stenting for six weeks. Other minor

complications were infrequently seen and managed conservatively.

## CONCLUSION

PCNL in pediatric population is safe with good stone free rate with minimal complications. Application of miniaturized instruments (mini PCNL) has further improved the outcome with comparable morbidity.

## CONFLICT OF INTEREST

None declared.

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