

## Original Research Article

# Percutaneous nephrolithotomy in the pediatric age group: a study from North Karnataka

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### ABSTRACT

**Background:** Nephrolithiasis is major problem in India. It is more prevalent in northern states of India and Karnataka is not an exception to this. Percutaneous nephrolithotomy (PCNL) has been accepted globally as a safe procedure with great success rate with less complication, and it is safe, effective, and suitable for pediatric cases. The aims and objectives of the study were to evaluate the indication of PCNL in children, to identify the complication, prevention and treatment of complication and to evaluate the efficacy and safely, management of kidney stones in children.

**Methods:** Study period Aug 2015 July 2018, total 56 cases of renal stones in pediatric age group admitted in our Hospital, a tertiary care centre. All the patients evaluated for complete urine analysis, urine culture and sensitivity, complete hemogram, renal parameter, X ray KUB (kidney, ureter, and bladder), ultrasound KUB etc.

**Results:** Small-stone (<2 cm) seen in 21.4% and large stone 64.2%. Following complications were noted- Pelvic perforations (3.5%), fever (7.1%) and hematuria (7.1%).

**Conclusions:** PCNL is safe and effective procedure for the managements of renal stones in children with acceptable morbidity.

**Keywords:** Percutaneous nephrolithotomy, Congenital malformations, Renal stones, Pediatrics age group

### INTRODUCTION

Urolithiasis is one of the oldest diseases known to humankind. It was commonly seen in Egyptian mummies. Nephrolithiasis is major problem in India. It is more prevalent in northern states of India.

Renal calculi are associated with complexities due to anatomical, congenital, metabolic abnormalities and high recurrence of stones which made us to think about the effective treatment modality for pediatric population.<sup>1,2</sup>

The goal of treatment is total clearance without any residual calculi, eradicates of causative micro organs, correction of metabolic or anatomic abnormalities as an effective management of UTI.

Percutaneous nephrolithotomy (PCNL) has been accepted globally as a safe procedure with great success rate with less complication, and it is safe, effective, and suitable for pediatric cases in all age groups and replaced the open surgeries.<sup>3-5</sup>

In Karnataka, its incidence is about 15% and in our hospital, urolithiasis incidence is about 70%, out of which pediatric incidence is about 8-10%.

The management of renal calculi the first successful pediatric PCNL reported in 1984.<sup>6-8</sup>

The under nourishment, high salinity and warm temperature are the causes of stone formation. The percutaneous nephrolithotomy a minimal invasive

surgery has taken major role for renal stones especially for children with advent of miniature procedure, lithotripsy using laser, stone extraction techniques, have greatly decreased the morbidity associated with open surgery.

Pediatric urolithiasis is associated with the infection, anatomic and metabolic abnormality which causes recurrence stone formation, Urolithiasis main aim of treatment is complete clearance eradication of urinary infection and correction of anatomic or metabolic abnormality.

PCNL is the treatment chosen for a large 2 or complex stones, as it has advantage of rapid and complete clearance of large stone burden in calibration with ESWL/RIRS. PCNL 3 remains an important efficacious treatment modality for renal calculi in childhood, because it offers optical and increase upper tract drainage and more efficient clearance of stone burden unlike ESWL.

Recent advancement in PCNL made to replace the standard dilatation techniques to small access tracts and hence complications are low in the experienced hands.

Correction of any underlying metabolic or anatomic abnormalities is crucial in the prevention of recurrence and in preserving the renal function.<sup>4</sup>

Minimal invasive methods have preferred the open procedure. In Children with renal stone should undergo complete anatomical and metabolic assessment.

Presently PCNL being as primary treatment in patients with the Large upper tract stone burden (1.5 cm), lower pole calculi of more than >1 cm stone, concurrent anatomic abnormalities impairing urinary drainage and stone clearance including the uretero-pelvic junction obstruction, infundibular stenosis, stones, in a calyceal diverticulum, cystine, struvite composition stones.

Aims and objectives of the study were to evaluate the indication of PCNL in children with age from 1 to 14 years, identification of risk factors (both anatomical and metabolic) for kidney stones in children, to identify the complication, prevention and treatment of complication, to evaluate the efficacy and safely, management of kidney stones in children by PCNL.

## **METHODS**

Study period was from August 2015 to July 2018. Total 56 cases of renal stones in pediatric age group admitted in our tertiary care centre.

The study was retrospective observational original study. All the patients evaluated for complete urine analysis, urine culture and sensitivity, complete hemogram, renal parameter, X ray KUB (kidney, ureter, and bladder),

ultrasound KUB region, IVU and noncontrast CT scan KUB region (for radiolucent calculi).

### ***Inclusion criteria***

Renal stones of all sizes more than 1 cm size; URS/ESWL has failed to clear the renal stones; anatomical abnormality which hampers the drainage and stones clearance; children with lower pole renal calculi with less than 1 cm drained by long narrow infundibulum, acute infundibulopelvic angle were included in the study.

### ***Exclusion criteria***

Poor general condition with CRF was excluded in the study.

### ***Statistical analysis***

All data collected is entered in excel sheet and statistical analysis done using SPSS software.

### ***Procedure***

Under general anaesthesia, retrograde catheterisation done by using, cystoscopy, did RGP under fluoroscopy then turned the patient to prone position. Under fluoroscopy guidance, puncture of desired posterior calyx done, after RGP delineation of PCS 56 done Determine the desired calyx containing the in stone is relation to 12<sup>th</sup> rib and intra costal puncture is planned the position of children is careful than adult where towel rolls put below chest than siff bolster. RGP done to know infundibular length, width and angle of entry to pelvis. The size of amplate sheath approximately measured on width of infundibulum. The tract made under c-arm is shortest straight tract and end on view punctured the desired calyx by using 18 G needle which coincides with "bull's eye sign" By using 0.035 guide wire, passed into system through 18 GIP needle, dilate the tract with fascial dilators followed by coaxial telescope dilators which is gradual controlled dilation. We referred to keep 12 for 14 F Nelaton catheter as Nephrostomy DJ stent placed in all the case. The PCNL staged procedure done, when renal insufficiency, bilateral renal calculi and intra operative bleeding and nephroscopy time exceeds the 60 minutes.

## **RESULTS**

Maximum number of cases (64%) had large stones and in 12% seen bilaterally. Malrotated kidney was the most common anomaly associated with renal stones (in 28.5% of cases).

On the first post operative day, X-ray KUB and ultrasound KUB done in all the patients to know the stone clearance before removal of nephrostomy; relook PCNL done in 2 cases for residual stones: single stage PCNL was 52 patients, two stages PCNL was 4 patients and blood transfusion was 2 patients.

**Table 1: Types of stones.**

Stone type	No. of patient	%
Small-stone less than 2 cm multiple	12	21.4
Large stone more than 2 cm	36	64.2
Stag horn stones	-	0
Bilateral	8	14.2

**Table 2: Congenital malformations.**

Congenital	Number	%
Horse shoe kidney	2	3.57
Malrotated kidney	16	28.5
Incomplete duplex moiety	4	7.4
Ectopic kidney	-	
Calyceal diverticulum	-	
Total	21	39.5

**Table 3: Complications noticed in the study group.**

Complications	Number	%
Pelvic perforations	2	3.5
Fever	4	7.1
Hematuria	4	7.1
Perinephric hematomas	0	0
Ileus	4	7.1
Sepsis	2	3.5

Fever, haematuria and ileus were the commonly observed complications in our study.

## DISCUSSION

PCNL is being used as monotherapy and in combination with SWL or RIRS in children achieving stone free rate that range from 68 to 100%.<sup>7-15</sup>

Recent large retrospective series of PCNL monotherapy have demonstrated high efficacy rate that approaches 90%.<sup>15</sup>

PCNL procedure concerned in children is radiation exposure, instrument size parenchymal damage and risk of complication like bleeding, sepsis. PCNL is a challenging technically, experience of surgeon is important.

Desai and coworker reported stone free rate of 89.8% using 14 F nephroscope and 20-24 F sheath, of these 61% needed multiple tracts and 45% needed staged procedures.<sup>16</sup> The results demonstrated that the number and size tracts were significantly associated with

postoperative hemoglobin decrease (mean 1.9 g/dl) and over all transfusion rate (14%).

Some studies have chosen to follow the primary PCNL adjunctive with SWL to clear the residual stone fragments in order to reduce the number of tracts and associated morbidity.<sup>17,18</sup> Samad et al reported 59% monotherapy stone free rates with 96% of cases done through single tract and 34.5% of primary failure were treated with SWL.<sup>19</sup> The cumulative stone free rate in all the patients were 93.8% with 3.6% transfusion rate. The aim of surgery is to give stone clearance without adding any morbidity.

In our centre, we have operated total number of patient 46, total renal units 64, out of 46 patients, 22 patients had congenital anomalies, the details are given in the table. All the cases done through lower calyx except Horse-shoe kidney where puncture done through upper calyx. Sex distribution in our study was male 24, female 22, children were 9.3 yr age (average), mean size of stone was 21.1 mm (smallest size is 15 mm and biggest is 26 mm) and maximum sheath used was 24 F.

Out of 46 children, only 2 patients required blood transfusion, rating to 3.5%. We did not use sandwiched therapy (SWL) and all the 64 renal units were subjected to the PCNL monotherapy only with success rate of 96.4%. Our complication rates are low and are in comparison with many series. Our main complications were fever, hematuria, ileus, which were treated with conservative treatment. Our success rates and complication rates were almost same as that of other series (Table 4).

PCNL advocated for children with significant stone, to avoid numerous SWL sessions under anesthesia and risk associated with repeated open surgery. Studies have proved that minimal scarring and no significant loss of function with pediatric PCNL in availability of expertise, small calibration instruments advanced energy sources, number, tracts can be placed with direct visualization of stone. Hence we have done PCNL intra costal approach as less thoracic complications in our institution.

Advantage PCNL is minimal complication with improved instruments as compared with techniques like mini-perc in children with renal stones.

In our study of 3 years duration total 46 children whose mean age was 8.6 years, mean stone size was 3.1 cm (total 32 renal units). We have used maximum sheath size 28 F, congenital anomalies detected in our study were 2 horse shoe kidney, 16 malrotated kidney and 4 incomplete moieties. Two patients underwent two sitting of PCNL and one patient was required blood transfusion (3.6%). Complications in our study were 4 patients fever, 4 patients haematuria, 4 of ileus and sepsis 2.

**Table 4: Comparison table with other similar studies.**

Study	No children/ renal units	Mean age (yrs)	Stone size (mm)	Maximum sheath size (Fr)	Transfusion (%)	Stone free (%)	Sandwich therapy	Complication (%)
<b>Badaway<sup>14</sup></b>	60	6	n/a	28	3.3	90	1.7	Fever 8.3 colon injury 1.7% open conversion
<b>Zeren<sup>15</sup></b>	55/62	7.9	16.8	30	23.9	86.9	1.6	Fever 29.8 open conversion
<b>Desai<sup>16</sup></b>	56	9.1	18.4	24	14.3	89.8	5.4	Urine leak 5.4
<b>Salah<sup>17</sup></b>	135/138	8.9	22.5	28	0.7	98.6	0	Urine leak 8
<b>Holman<sup>18</sup></b>	38	8.9	22.5	28	0.4	98.5	0	Fever 1.1 Urine leak 8
<b>Samad<sup>19</sup></b>	1692188	8.2	27.2	28	4	59.3	34.5	Fever 42.8 hyponnatremia 06 obstruction 06
<b>Shokeir<sup>20</sup></b>	75/82	9.3	21.1	24	3.5	96.42	0	Fever 7.14% Haematuria 7.14
<b>Our study</b>	46/64	9.3	21.1	24	3.5	96.42	0	Fever 7.14 % Haematuria 7.14 Ileus 7.14, sepsis 3.57 %

## CONCLUSION

PCNL is safe and effective procedure for the managements of renal stones in children. With acceptable morbidity with improved clearance rate PCNL is now the preferred procedure in the management of large kidney stone burden in children.

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