

Paediatric PCNL—Our tertiary centre care experience.

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Abstract

Background: Nephrolithiasis is major problem in India. Maharashtra and especially Vidarbha region 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 safety for management of kidney stones in children.

Methods: Study period extended from Dec 2016 to March 2020, total 27 cases of renal stones in paediatric age group admitted in our Hospital, a tertiary care centre. All the patients are evaluated for complete urine analysis, urine culture and sensitivity, complete hemogram, renal parameter, X-ray KUB (kidney, ureter, and bladder), ultrasound KUB etc. Then patients were undergone for PCNL without any sandwich therapy such as ESWL. The post-op outcomes were evaluated and scrutinized.

Results: 27 patients were undergone in this study of which 16 were male and 11 were female. Small-stone (<2 cm) seen in 25.9% patients and large stone 51.8%. Following complications were noted-pain (33.3%), hematuria (11.1%), sepsis (7.4%), lung atelectasis (7.4%), fever (3.7%), ileus (3.7%). Of all patients, 2 patients were having ectopic renal units.

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

Keywords: Paediatric PCNL, Nephrolithiasis, Infection, Fever.

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Introduction

Nephrolithiasis is a major problem in India, more or less equal in all over India. Renal calculi in paediatric population are mostly associated with complexities, such as anatomical, congenital, metabolic abnormalities results in high recurrence of stones which made us to think about the effective treatment modality [1,2]. The goal of treatment is total clearance without any residual calculi and with minimum complications.

Percutaneous Nephrolithotomy (PCNL) has been accepted globally as a safe procedure with great success and with less complication, for pediatric cases also [3-5]. In Maharashtra, incidence of renal calculi is about 15% and in our hospital, urolithiasis incidence is about 70%, out of which pediatric incidence is about 8%-10%. In 1984, the first successful paediatric PCNL has been reported as management of renal calculi [6-8]. The prominent causes of stone formation are under nourishment, high salinity and warm temperature. Because of advent of miniature procedure, lithotripsy using laser, stone extraction techniques, percutaneous lithotripsy has taken major role for treatment of renal calculi in paediatric population with less morbidity than open procedure.

Correction of any underlying metabolic or anatomic abnormalities is crucial in the prevention of recurrence and in preserving the renal function [4]. Presently PCNL being as

primary treatment for 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, cystiene, 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 safety, in the management of kidney stones in children by PCNL.

Materials and Methods

Period

This study conducted in GMC and SS Hospital between period December 2016 to November 2020.

Inclusion criteria

- All patients with age group less than 15 yrs.
- Patients with renal stones of sizes more than 1 cm size.

Exclusion criteria

Patients with age group more than 15 yrs.

Study type

Observational retrospective study. All the patients are investigated with 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).

Statistical analysis

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

Procedure

Under general anesthesia, retrograde catheterization done with the use of cystoscopy followed by RGP under fluoroscopy then turned the patient to prone position. Under fluoroscopy guidance, puncture of desired posterior calyx done, after delineation of PCS with RGP. The desired calyx containing the stone in relation to 12th rib and infra costal puncture is planned. RGP has been done to know infundibula length, width and angle of entry to pelvis. The size of amplatz 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 G IP needle, dilate the tract with facial dilators followed by coaxial telescope dilators which are gradual controlled dilatation. We used 19 F Dresden nephroscope with 22 F amplatz sheaths. We preferred to keep 12 or 14 F nelton catheter as nephrostomy. DJ stent placed in all the case. We used to open the nephrostomy after 4 hrs which we blocked just after the procedure for temponade effect. The PCNL staged procedure done, when renal insufficiency, bilateral renal calculi and intra operative bleeding and procedure time exceeds the 60 minutes.

Discussion

PCNL either used as monotherapy or in combination with SWL or RIRS in children to achieve stone free rate that range from 68% to 100% [7-15]. Some retrospective series with PCNL as monotherapy demonstrated high efficacy rate, approximately 90%. But the concern for PCNL in children is radiation exposure, instrument size, parenchymal damage and risk of complication like bleeding, sepsis. In PCNL, experience of surgeon is important as it is a technically challenging procedure. Desai and co-worker showed stone free rate of 89.8% using 14 F nephroscope with 20-24 F sheath, in which 61% needed multiple tracts and 45% needed staged procedures [16]. They concluded that the number and size of tracts directly proportionate to postoperative haemoglobin decrease (mean 1.9 g/dl) and over all transfusion rate (14%) (Table 1).

Sex	No. of patient	Percentage
Male	16	59.26
Female	11	40.74
Total	27	

Table 1. SWL to primary PCNL.

Some studies showed addition of SWL to primary PCNL for clearing residual stone fragments and to reduce the number of tracts with associated morbidity [17,18]. Samad et al. reported 59% as stone free rate with PCNL as monotherapy and in that

96% of cases done through single tract and 34.5% of primary failure were treated with SWL [19]. The cumulative stone free rate in all the patients were 93.8% with 3.6% transfusion rate (Table 2).

Stone Type	Number of Patients	Percentage
Small stones less than 2 cm multiple	7	25.93
Large stone more than 2 cm	14	51.85
Stag horn stones	2	7.41
Bilateral	4	14.82
Total	27	

Table 2. The cumulative stone free rate.

The aim of surgery for renal calculi is morbidity free stone clearance in every aspect. In our centre, we have operated total 27 patients, with total renal units of 34, out of 2 patients had

congenital anomalies, and 4 patients were operated on both sides of renal units. Sex distribution in our study was male 16, female 11, while mean age of children was 11 years (Table 3).

Congenital Condition	Number	Percentage
Horseshoe kidney	0	
Malrotated kidney	0	
Incomplete duplex moiety	0	
Ectopic kidney	2	7.4
Calyceal diverticulum	0	
Normal renal units	25	92.59

Table 3. Congenital condition.

Mean size of stone was 22 mm (smallest size was 18 mm and biggest is 30 mm) and maximum sheath used was 24 F. Out of 27 children, only 2 patients required blood transfusion, rating

to 7.4%. We did not used SWL with primary PCNL to clear the residual fragments and all the 35 renal units were subjected to the PCNL monotherapy only with success rate of 98% (Table 4).

Complications	Number	Percentage
Pain	9	33.34
Fever	1	3.7
Hematuria	3	11.11
Ileus	1	3.7
Pelvic perforation	0	0
Perinephric haematoma	0	0
Sepsis	2	7.4
Lung atelectasis	2	7.4

Table 4. The matrix composition.

We observed that, the preoperative stone size were small as compared to intraoperative observed size. We have seen that the matrix composition around stone cause to increase in actual size and witnessed in 10 cases. The preoperative stenting has been followed in 12 cases, which shows very good results in case of pyelonephritis. However, in 3 cases we observed there was no pus but only matrix composition that gives appearance of pus.

Although North American data of analyzed stone shows calcium oxalate as major composition in our series we got calcium ammonium magnesium phosphate as major constituent. Out of 27 patients, 12 patients have triple phosphate stone as major contributor, while second one has uric acid as composition which is 7 in number due to high incidence of blood dyscrasias such as sickle cell anemia and thalassemia which is prevalent in this region (Table 5).

Stone composition (Major Constituents)	Number	Percentage
Calcium oxalate	4	14.8
Hydroxyapatite	2	7.4
Brushite	2	7.4
Uric acid	7	25.9
Struvite	12	44.4
Cystine	0	0
Total	27	

Table 5. Stone composition (major constituents).

We observed that in supra 12th rib puncture the pain severity was higher with grade 2 modified Cleiven classification which

require postoperative analgesia for longer time. Although, Sharma et al. showed supracostal puncture is the positive step towards the ongoing development for refinement of

standardized procedure at the cost of injury to lung and pleura which can be managed.

Bryniarski et al. showed the erector spinae plain block is the effective way to reduce the postoperative pain although for shorter period. Hence to curb the pain which is a major complication in our series, we have followed erector spinae plain block for 5 patients and it shows very good results which reduced the pain score to 3 out of 10. The smaller size nephrostomy tube and local anaesthesia insertion at nephrostomy site are some other measures which can reduce postoperative pain.

We followed to place DJ stent and nephrostomy tube for every operated patient. We kept nephrostomy tube block for initial 4 hrs followed back to open it. We have seen by following this practice, the complication such as sepsis, postoperative fever has reduced in our series. Celik et al., showed that with change in size of sheath, there is no significant difference in time to access the collecting system, operative time, duration of nephrostomy and average postoperative hospital stay. As we used 19 F Dresden Nephroscope with 22 F Amplatz sheath, the operating time require is more or less equal to 24 F sheath.

We followed the operated patients and 4 patients presented with recurrent stones, which have treated with SWL therapy. One reason for not using PCNL and SWL as sandwich therapy because most patients presented with either with infection or complex anatomy as we worked in tertiary care centre of our region. We operated on 2 ectopic renal units. For that we sandwiched laparoscopic procedure to dissect out retroperitoneum and then took puncture for PCNL.

Seitz et al. showed fever as most common complication with incidence of 10.8%, followed by bleeding as 9.76%. Ileus (0.22%), subcapsular hematoma (0.11%), urine leakage (2.17%) and renal pelvic perforation (0.54%) managed by watchful waiting needing no active intervention. Our main complications were pain 33.34%, fever 3.7%, hematuria 11.11% which were treated with conservative treatment. In treatment of pain followed of procedure analgesic treatment was continued for little more time. While haematuria has been treated with addition of IV fluids, hydration and diuretic with conservative management. For fever the addition or change of antibiotics was not required. In this series, lung atelectasis was prominently seen in supra 12th rib access which later managed with conservative treatment.

PCNL advocated for children with significant stone, to avoid numerous SWL sessions under anaesthesia and which may leads to persistent residual stones. 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. Advantage of PCNL is minimal complication with improved instruments as compared with techniques like mini-perc in children with renal stones.

Result

In our study of 4 years duration total 27 children underwent in this study. The mean age of all patients was 11 years where as mean stone size was 22 mm (total 34 renal units). We have used maximum sheath size 22 F; by using this we have observed there is no any reduction in pain severity in post-op period. 2 patients were detected with congenital anomalies as ectopic kidney which was operated by laparoscopic assisted technique. Patients presented with complications such as pain 9, fever 1, hematuria 3, ileus 1, sepsis 2 and lung atelectasis 2.

We observed that after opening of nephrostomy tube in post-op period and pre-op DJ stenting are some of the techniques that reduces sepsis episodes. Triple phosphate was the major contributor of stone composition seen in 12 patients while 4 patients were having calcium oxalate with 14 patients were having stone size more than 2 cm.

Conclusion

In this study, we concluded that most of children were presented in late period with sepsis. The congenital anomaly seen in this study is with 2 patients only. The post-operative pain is the main complication for the patients which we tried to reduce by giving.

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