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ORIGINAL ARTICLE

Stone clearance by percutaneous nephrolithotomy (PCNL) in paediatric population.

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ABSTRACT… Objective: To determine the stone free rate by PCNL in pediatric population. **Study Design:** Descriptive Study. **Setting:** Department of Urology & Kidney Transplantation, Faisalabad Medical University and Affiliated Hospitals. **Period:** July 2019 to July 2020. **Material & Methods:** Total 55 patients were enrolled. After history, examination, relevant pre-operative investigations and informed consent, the patients underwent standard prone PCNL, with ureteral catheter placement, system puncture under fluoroscopic/ultrasound guide, tract dilatation, nephroscopic stone manipulation and retrieval. Pre and post operative images were compared for determinations stone clearance. Other relevant data operative time, need of blood transfusion & complications were recorded. All the information was documented on a proforma. **Results:** In our study, of 55 cases, 87.27% (n=48) were between 2-10 years of age whereas 12.73% (n=7) were between 11-14 years of age, mean+sd was calculated as 8.44+2.31 years. 56.36% (n=31) were male and 43.64% (n=24) were female. Frequency of stone clearance was recorded in 80% (n=44) whereas 20% (n=11) didn't stone clearance. **Conclusion:** PCNL is a safe and effective treatment option for management of renal stones in pediatric population.

Key words: Pediatric Population, Urolithiasis, Percutaneous Nephrolithotomy (PCNL), Efficacy.

INTRODUCTION

The incidence of stone formation in developing countries is 5-15%.[1] Pakistan is located in the center of a region having high incidence of urolithiasis. This region is known as the Afro-asian stone belt. Children and adults are both affected equally by renal stone disease. Urolithiasis in pediatric population affects 13% of all patients suffering from stone disease. It also shares 60% load of pediatric urological diseases.[2] Renal calculi are mostly due to metabolic derangements and are mainly calcium oxalate, uric acid and magnesium ammonium phosphate stones.[3]

Most commonly applied treatment modalities in pediatric nephrolithiasis are extracorporeal shockwave lithotripsy (ESWL) and endourological surgeries. However, open surgery is the only option in some situations.[4] ESWL is recommended for stone size of up to 2cm diameter with stone free rates of about 90% with stone size of less than 1 cm and 80% for 1-2 cm stones. Greater stone size increases the requirement for additional lithotripsy sessions. In short term studies 67-93% of the patients treated with ESWL were stone free while in long-term follow up the stone free rate of 57-92% has been reported.[5]

PCNL is the gold standard treatment for nephrolithiasis but it has specific side effects.[6] In children the PCNL is a well-established safe and efficacious procedure owing to short treatment period and high stone free rates.[7] The burden of disease along with disease nature is complex in case of open surgery but still it provides comparable results to that of minimally invasive methods. Large number of populations belonging to developing world is the main reason that will maintain the scope of open urological procedures for long time. Generally, the candidates for open surgery are those young children who have congenitally obstructed

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system or the ones with large stones.[8] PCNL as a primary option for stones of >2cm size and for stones of >1cm size present in lower pole of the kidney is recommended by European Association of Urology.[9] A single treatment with percutaneous nephrolithotomy (PCNL) removes 80-90% of stones and that makes it an effective way of treating stones that are complex or large in pediatric population.[10] Treatment of pediatric urinary stone disease necessitates a balance between morbidities related to the procedure and stone free rate.[11] A total of 4.3% cases comprise of pediatric urinary stone disease.[12] Treatment and follow up in pediatric population is very different from adults. As socioeconomic status in Pakistan is very low, so recurrence is a major problem. PCNL helps in giving a stone free status to the patient with minimal complication rates in a single hospital stay. PCNL can be a life threatening procedure in under experienced hands. This is of great importance in children where body reserves are fragile and marginal. Before starting PCNL in pediatric age group, learning curve should be taken into consideration. In our study, we report our technique and analysis regarding PCNL in pediatric age group.

MATERIAL & METHODS

After ethical review committee approval, Fifty five eligible patients fulfilling the inclusion criteria of age 2-14 years, renal stone of size 1-3 cm, stones that are refractory to ESWL treatment were enrolled with the objective of determining the efficacy of PCNL in terms of stone clearance rate in pediatric population. Patients with concomitant congenital renal anomalies, unfit for general anesthesia, PCNL converted to open surgery & patients with radio-lucent stones & Non-functioning kidney were excluded. After consent from the parents & preoperative evaluation, patients underwent standard prone PCNL, with ureteral catheter placement, system puncture under fluoroscopic/ultrasound guide, tract dilatation, nephroscopic stone manipulation and retrieval. Pre and post operative images were compared for determinations stone clearance. Other relevant data operative time, need of blood transfusion & complications were recorded. All the data was collected on a proforma. Stone clearance was assessed in each patient on 2nd post-operative day by X-Ray (Digital) - KUB and USG-Abdomen (KUB). Patients having stone fragments which were less than 4 mm in diameter and asymptomatic were declared stone free. These fragments were referred as clinically insignificant residual fragments (CIRF). All the data was analyzed by using SPSS v-20. Mean and standard deviation was calculated for all quantitative variables like Age and pre-operative stone size. Frequency and percentage was calculated for all qualitative variables like gender, post-op residual stone and complete stone clearance. Effect modifier like age, gender and size of stone were controlled by stratification. Post-stratification chi-square test was applied, p-Value <0.05 was taken as significant.

RESULTS

A total of 55 cases fulfilling the selection criteria were enrolled to determine the stone clearance rate by percutaneous nephrolithotomy (PCNL) in pediatric population. Age distribution shows that 87.27%(n=48) were between 2-10 years of age whereas 12.73%(n=7) were between 11-14 years of age, mean+sd was calculated as 8.44+2.31 years. (Table-I) Gender distribution shows that 56.36% (n=31) were male and 43.64% (n=24) were female. Preoperative stone size was calculated as 2.56+0.50cm. Frequency of stone clearance was recorded in 80% (n=44) whereas 20% (n=11) had no stone clearance. (Table-II)

Effect modifier like age, gender and size of stone were controlled by stratification. Post-stratification chi-square test was applied, p-Value <0.05 was taken as significant. (Table-III,IV)

Age (in years)	No. of Patients	%
2-10	48	87.27
11-14	7	12.73
Total	55	100
Mean+SD	8.44+2.31	

Table-I. Age distribution (n=55)

Stone Clearance	No. of Patients	%
Yes	44	80
No	11	20
Total	55	100

Table-II. Frequency of stone clearance (n=55)

Age (in years)	Stone Clearance		P-Value
	Yes	No	
2-10	39	9	0.54
11-14	5	2	

Table-III. Stratification for frequency of stone clearance with regards to age

Stone Size	Stone Clearance		P-Value
	Yes	No	
1-2cm	19	5	0.89
3cm	25	6	

Table-IV. Stratification for frequency of stone clearance with regards to stone size

DISCUSSION

Adults and children are equally affected by urinary stone disease in Pakistan. Increased chances of recurrent stone disease has lead to recommendation of minimally invasive procedures. Children suffering from renal stone disease are frequently treated by percutaneous nephrolithotomy (PCNL). In this study, we report our clinical experience in treating children having renal stone by PCNL.

Our department is a tertiary care urology center which attracts patients from all over the district and its suburbs. As a result, we have a great opportunity to study the urinary stone disease in detail especially in the pediatric population. We also have the opportunity to study different treatment modalities which are used in managing this disease in children of our population.

In our study, of 55 cases, 87.27% (n=48) were between 2-10 years of age whereas 12.73% (n=7) were between 11-14 years of age, mean+sd was calculated as 8.44+2.31 years. 56.36% (n=31) were male and 43.64% (n=24) were female. Frequency of stone clearance was recorded in 80% (n=44) whereas 20% (n=11) had no stone clearance.

Our results are similar to the study conducted in Turkey which shows that a single treatment with percutaneous nephrolithotomy (PCNL) removes 80-90% of stones and that makes it an effective way of treating stones that are complex or large in pediatric population.[10]

Another series reported by Sultan and associates[13] showed the similar results where they reported efficacy of PCNL for treating kidney stones in children was 89%, They included total 500 PCNL procedures in their study. Ages of the children enrolled in their study ranged from 8 months to 15 years with 35% children aged less than 5 years. Male children were 2.3 times more than females. Stone clearance rates of 89% were recorded with monotherapy. Open surgery was required in 2.6% cases due to failed tract formation and excessive hemorrhage. It was concluded that PCNL for simple and complex renal stones in children can be considered a safe procedure in children including pre-school age group.

Rajeev Kumar and others[14] evaluated the efficacy of PCNL in treatment of pediatric staghorn stones using adult equipment in children having age less than 16 years. They concluded that it is an effective procedure in this age group.

PCNL is a procedure which can offer better stone clearance in expert hands with acceptable complication rates. Recent studies advocate that complex staghorn stones can be effectively treated using this approach. The access to the collecting system can be gained through ultrasound or fluoroscopic guidance. It depends upon personal preference and experience. Ultrasound has the advantage of visualization of adjacent structures thereby avoiding their injury. Smaller nephroscopes and latest energy sources will definitely help in decreasing morbidities and improving clearance rates.

CONCLUSION

Frequency of stone clearance is high with percutaneous nephrolithotomy (PCNL) in pediatric population.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Muhammad Irfan Munir	Operating Surgeon, Supervised the project.	
3	M. Tahir Bashir Malik	Review & Formatting of Manuscirpt.	
4	Moin Anwar	Data Collection.	
5	Muhammad Saifullah	Manuscript Writing, Literature Review.	
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