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ORIGINAL ARTICLE

Efficacy of Micro PCNL for renal stones in pediatric age group

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ABSTRACT

Background: Renal calculi is mineral deposit in the renal calyces and pelvis that are found free or attached to the renal papillae. Management of kidney stone disease in pediatric population is a challenging condition in urology practice. While the incidence of kidney stone is increasing in those group, technological innovations have contributed to the development of minimally invasive treatment of urinary stone disease such as mini-percutaneous nephrolithotomy (mini-PCNL), micro-PCNL, ultra mini-PCNL.
Aim: To find the frequency of stone clearance and post op hematoma after micro PCNL in pediatric patients with renal stones.
Place and duration of study: Department of Urology, Shaikh Zayed Hospital, Lahore from 25-01-2020 to 25-07-2020.
Methodology: After approval from the hospital ethical committee, 60 all the children of 18 years presenting in Department of Urology fulfilling the inclusion criteria were included. An informed consent was obtained from patients. Before performing micro PCNL renal stone was confirmed on CT-Scan KUB plain. After proper selection of the patients, they were prepared for surgery. After preparation patients were put on list for micro-PCNL. Surgery was performed. Post operatively CT-Scan KUB plain was performed to see the stone clearance four weeks after surgery. Post hematoma was noted according to Clavien Grading Scoring.
Results: Out of 60 patients, 19(31.7%) were in group ≤10 years of age whereas 41(68.3%) in were in group 11-18 years of age, mean age was calculated as 12.90±3.16 years. There were 44(73.3%) were male whereas 16(26.7%) were females. Frequency of stone clearance was 56(93.33%) and post op hematuria was 4(6.66%) after micro PCNL in pediatric patients with renal stones.
Conclusion: We found that, after Micro PCNL in pediatric patients with renal stones there were good stone clearance rate and less hematuria. So micro PCNL is good technique for stone clearance and less complications occurred.
Keywords: Urinary tract stone, PCNL, Renal Calculi.

INTRODUCTION

Renal stone disease, also known as nephrolithiasis, has become an important cause of childhood morbidity and healthcare expenditure worldwide. Consequences of renal stones include pain, urinary tract infection (UTI), urinary obstruction and renal damage that can even lead to renal failure. The incidence among the adult population which was estimated to be about 12% is also reported to be increasing worldwide[1] Incidence of stone disease is becoming more common in pediatric age group nowadays. The causes of this higher incidence are metabolic, anatomical factors and higher stone reoccurrence rates. The major purpose of surgical intervention is to clear the stones completely and to maintain the kidney in a properly functioning state by giving least morbidity to the patient[2].

Renal stones can be treated either by extracorporeal shock wave lithotripsy (ESWL) or percutaneous nephrolithotomy (PCNL). Percutaneous nephrolithotomy is the treatment of choice for renal stones in adult as well as pediatric age group[3]. PCNL is an endoscopic surgical procedure for treating large renal calculi (2cm in diameter and larger) for which ESWL has failed. The benefit of low early morbidity, early return to work and recreational activities has also popularized PCNL for the treatment of renal calculi. Today, most renal stones may be successfully treated by PCNL and open stone surgery is needed for very few cases. Although ultrasonography has been used to gain renal access in some institutions, PCNL is performed under fluoroscopy in most centers worldwide, as it has the advantage of being a one stage procedure. Fluoroscopy has been used at almost every step of the PCNL, including percutaneous renal access, dilation of the tract and stone manipulation[1].

Standard PCNL was inaugurated by Fernstrom and Johansson in 1976 using tract size of 26-32 F. PCNL provides more stone free rates at the cost of higher complication rate and blood loss[4]. According to Jackman and colleagues miniaturization was started when Mini PCNL was inaugurated. Advancement in technique is developing by miniaturization of technology through Optic puncture systems, smaller access sheath and smaller instruments to provide less invasive approach. By the advent of newer techniques, there is a gross decrease in open surgical procedures for renal stones.[5] The technique was further modified when Desai and colleagues performed PCNL through 4.85 F tract using “all seeing needle” in 2011 regarded as m-PCNL (Micro-PCNL). The advantage of the technique is to clear the stones via smallest available tract size.[6] The topic of miniaturization, especially Micro PCNL (m-PCNL) is under reported in our area. So the purpose of the study is to provide institute based experience to show the efficacy of this newer technique in terms of higher stone free rates and lower complication rates[3]. This is the systematic review to report on outcomes of miniaturized PCNL (m-PCNL, UMP) in the pediatric population. The outcomes suggest a good SFR for stones between 10 and 20mm with an overall complication rate of 11.2%. While there was a higher incidence of renal colic with m-PCNL, the incidence of hematuria and renal extravasation or renal pelvic perforation was higher with UMP[6].

After micro PCNL treatment 14% complications were reported and majority of these were Clavien I and II. Clavein I complications included patients each with fever and hematuria and 29% Clavein II complications. In Clavein II complications included patients who needed blood transfusion. Jones and his colleagues (2017) concluded that use of these smaller instruments can deliver a stronger safety profile while achieving good stone clearance[7].

MATERIAL AND METHODS

A total of 60 cases using 95% confidence level and 10% margin of error and taking expected frequency of clearance was 80.9%. Age group 0-18 years, patients with renal stones. Patients of both sexes. Patients were excluded from the study i.e. positive urine culture, unwilling to participate in the study, patients with urosepsis, patients with renal parenchymal stones, stones size larger than 1.8cm. After approval from the hospital ethical committee, 60 all the children of 18 years presenting in the

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Department of Urology were included in the study. An informed consent was obtained from them after discussion of risk versus benefit ratio. The observation sheet was used to know the demographic information, history of the patients and investigation for diagnosis which were mentioned in the observation sheet. Before performing micro PCNL renal stone was confirmed on CT-Scan KUB plain. The stone size and location was confirmed in CT-Scan KUB plain. Patients were included in the study according to inclusion criteria. Patients with positive urine culture reports were excluded from the study. After proper selection of the patients, they were prepared for surgery. After preparation patients were put on list for micro-PCNL. Surgery was performed. Post operatively CT-Scan KUB plain was performed to see the stone clearance four weeks after surgery

RESULTS

A total of 60 patients fulfilling the inclusion/exclusion criteria were enrolled to study the frequency of stone clearance and post op hematoma after micro PCNL in pediatric patients with renal stones. Age distribution of the patients was done, it shows that out of 60 patients, 19(31.7%) were between ≤10 years of age whereas 41(68.3%) in were between 11-18 years of age, mean age was calculated as 12.90±3.16 years (Table 1). Gender distribution of the patients was done, It shows that 44(73.3%) were male whereas 16(26.7%) were females (Table 2). Frequency of stone clearance was 56(93.33%) and post op hematuria was 4(6.66%) after micro PCNL in pediatric patients with renal stones. The data was stratified for age, gender, size of stone and location of stone of the patients in Table 3-10 respectively.

Table 1: Distribution of age (n=60)

Age (years)	No.	Percent
<10	19	31.7
11-18	41	68.3
Mean± SD	12.90±3.16	

Table 2: Gender distribution (n=60)

Gender	No.	Percent
Male	44	73.3
Female	16	26.7

Table 3: Stratification for stone clearance with respect to age

Age (years)	Stone clearance		P value
	Yes	No	
< 10	19 (31.7%)	0	0.159
11-18	37 (61.7	4 (6.7%)	

Table 4: Stratification for stone clearance with respect to gender

Gender	Stone clearance		P value
	Yes	No.	
Male	40 (66.7%)	4 (6.7%)	0.212
Female	16 (26.7%)	0	

Table 5: Stratification for stone clearance with respect to size of stone

Size of stone	Stone clearance		P value
	Yes	No	
<2cm	23 (38.3%)	0	0.103
>2cm	33 (55.0%)	4 (6.7%)	

Table 6: Stratification for post op hematuria with respect to age

Age (year)	Post of hematuria		P value
	Yes	No	
< 10	0	19 (31.7%)	0.159
11-18	4 (6.7%)	37 (61.7%)	

Table 7: Stratification for post op hematuria with respect to gender

Gender	Post of hematuria		P value
	Yes	No	
Male	4 (6.7%)	40 (66.7%)	0.212
Female	0	16 (26.7%)	

Table 8: Stratification for post of hematuria with respect to size of stone

Size of stone	Post of hematuria		P value
	Yes	No	
<2cm	0	23 (38.3%)	0.103
>2cm	4 (6.7%)	33 (55.0%)	

Table 9: Stratification for post of hematuria with respect to location of stone

Location	Post op hematuria		P value
	Yes	No	
Lower pole	0	1 (1.7%)	0.007
Middle pole	4 (6.7%)	14 (23.3%)	
Upper pole	0	41 (68.3%)	

DISCUSSION

Kidney stone disease is a crystal concretion formed usually within the kidneys. It is an increasing urological disorder of human health, affecting about 12% of the world population. It has been associated with an increased risk of end-stage renal failure. The etiology of kidney stone is multifactorial. The most common type of kidney stone is calcium oxalate formed at Randall's plaque on the renal papillary surfaces. The mechanism of stone formation is a complex process which results from several physicochemical events including super saturation, nucleation, growth, aggregation and retention of urinary stone constituents within tubular cells. These steps are modulated by an imbalance between factors that promote or inhibit urinary crystallization[8].

In current study, we found that the frequency of stone clearance was 56(93.33%) and post op hematuria was 4(6.66%) after micro PCNL in pediatric patients with renal stones. Age distribution of the patients was done, it shows that out of 60 patients, 19(31.7%) were between ≤10 years of age whereas 41(68.3%) in were between 11-18 years of age, mean age was calculated as 12.90±3.16 years and there were 44(73.3%) were male whereas 16(26.7%) were females. Non-obstructing kidney stones produce no symptoms or signs apart from hematuria. However, the kidney stone may cause severe pain, usually accompanied by nausea, vomiting and hematuria (renal colic) when it passes into the ureter. Patients may also complain of urinary frequency and urgency. These signs and symptoms lead to many emergency department visits and hospitalization. The pattern of the pain from stone depends on its location: a stone in the upper ureter leads to pain in the flank that may radiate to the upper abdomen. When the stone is in the lower ureter, pain may radiate to the ipsilateral testicle in men or labium in women. If the stone is lodged at the ureterovesical junction, the main symptoms will be urinary frequency or urgency.

Stones are more common in men than in women, and stone types differ somewhat between the sexes; in children, reported frequency of stone types differs modestly from those in adults, but the sexes are affected about equally.[9] Periodic studies of the United States population, called the National Health and Nutrition Examination Surveys, show that the prevalence of stones has been increasing over the past 30 years in both sexes.[10] The most recent survey found that 7th decade almost 12% white men and 6% white women reported having had a kidney stone; the prevalence in African Americans is less than half that in caucasians, but has also been increasing.[11] In the United States, kidney stone affects 1 in 11 people, and it is estimated that 600,000 Americans suffer from urinary stones every year. In Indian population, about 12% of them are expected to. In the United States, kidney stone affects 1 in 11 people, and it is estimated that 600,000 Americans suffer from urinary stones every year. In Indian population, about 12% of them are expected to have urinary stones and out of which 50% may end up with loss of kidney functions[8].

In a study the mean stone size ranged from 12 to 16.5mm, with the youngest patient being 7 month old. The mean operative time and hospital stay were 61 minutes and 2.5 days, respectively and the mean initial and final SFR ranged from 67.5% to 92% and 80% to 100% in micro PCNL. The SFR mean were reported

immediate surgery and after four weeks of surgery[6]. After micro PCNL treatment 14% complications were reported and majority of these were Clavien I and II. Clavein I complications included patients each with fever and hematuria and 29% Clavein II complications. In Clavein II complications included patients who needed blood transfusion. Percutaneous nephrolithotomy (PNL) is the procedure of choice for large renal stones. Since its introduction in 1976, many aspects of the operative technique and the endoscopic equipment have had constant evolution, increasing the success rates of the procedure. We performed a literature search using Entrez PubMed from January 2000 to July 2007 concerning PNL and many aspects related to all steps of the procedure. Percutaneous nephrolithotomy (PNL) is accepted as the procedure of choice for the treatment of large or complex renal calculi.[12]Since its introduction in 1976[13] the operative technique and the endoscopic equipment have had constant evolution, increasing the success rates and decreasing complications and morbidity.

The first pediatric PCNL was described using a 15 F peel-away sheath and 10 F pediatric cystoscope by Helal et al in 1977. Yet, this technique was developed using an 11 F access sheath by Jackman et al in pediatric patients. Since then, the new form of PCNL has become a treatment option for adults as well. The first 12 F nephroscope was presented to perform mini-PCNL in 2001. The new device consisted of 15 F and 18 F sheath, a system of continuous low-pressure irrigation and a 6 F working channel. In time, this technique has developed and also accumulated in the pediatric patients for the treatment of renal stones regardless of the size of the stone. There is no common consensus as to exact size that is used for mini-PCNL, but usually access sheath below 20 F is accepted. Mini-PCNL is performed under general anesthesia. The most common serious complication PNL is bleeding requiring transfusion. Zeren and colleagues reported significant intraoperative hemorrhage requiring transfusion in 24% of their patients. On review of their patients, they found an association of transfusion with operative time, stone burden and sheath size. They also postulated that the use of rigid nephroscopes and over-levering on the kidney may have led to increased bleeding. More recent studies have demonstrated much lower rates of transfusion (<5%) with an association between both tract number and size and need for transfusion.

CONCLUSION

In our study frequency of stone clearance and post op hematoma after micro PCNL in pediatric patients with renal stones. We found the frequency of stone clearance was 56(93.33%) and post op hematuria was 4(6.66%) after micro PCNL in pediatric patients with renal stones. There were good stone clearance rate and less hematuria. So micro PCNL is good technique for stone clearance and fewer complications occurred.

REFERENCES

1. Perera I. Renal stones in children: evaluation and medical management. Sri Lanka J Child Health, 2016;45(1).
2. Jones P, Bennett G, Aboumarzouk OM, Griffin S, Somani BK. Role of minimally invasive percutaneous nephrolithotomy techniques micro and ultra-mini PCNL (<15F) in the pediatric population: A systematic review. J Endourol, 2017;31(9), 816-824.
3. Liu Y, Alsmadi J, Zhu W, Liu Y, Wu W, Fan J, Zeng G. Comparison of super-mini PCNL (SMP) versus Miniperc for stones larger than 2cm: a propensity scorematching study. World J Urol, 2018;36(6), 955-961.
4. Istanbulluoglu OM, Ozturk B, Cicek T, Gonen M, Ozkardes H. Case report: bilateral simultaneous tubeless and stentless percutaneous nephrolithotomy. J Endourol, 2008;22(1), 25-28.
5. Simayi A, Liu Y, Yiming M, AlSmadi J, Yusufu A, Alimu Y, Wu W. Clinical application of super-mini PCNL (SMP) in the treatment of upper urinary tract stones under ultrasound guidance. World J Urol, 2018;1-8.
6. Jones P, Bennett G, Aboumarzouk OM, Griffin S, Somani BK. Role of minimally invasive percutaneous nephrolithotomy techniques—micro and ultra-mini PCNL (<15F) in the pediatric population: A systematic review. J Endourol, 2017;31(9), 816-24.
7. Bagcioglu M, Demir A, Sulhan H, Karadag MA, Uslu M, Tekdogan UY. Comparison of flexible ureteroscopy and micropercutaneous nephro-lithotomy in terms of cost-effectiveness: analysis of 111 procedures. Urolithiasis. 2016;44(4):339-44.
8. Alelign T, Petros B. Kidney stone disease: an update on current concepts. Advances Urology. 2018.
9. Stapleton FB. Childhood stones. Endocrinol Metab Clin North Am. 2002;31:1001-1015.
10. Stamatelou KK, Francis ME, Jones CA, Nyberg LM, Curhan GC. Time trends in reported prevalence of kidney stones in the United States: 1976–1994. Kidney Int. 2003;63(5):1817-23.
11. Taylor EN, Stampfer MJ, Curhan GC. Obesity, weight gain, and the risk of kidney stones. JAMA. 2005;293(4):455-62.
12. Preminger GM, Assimos DG, Lingeman JE, Nakada SY, Pearle MS, Wolf JS, Jr, et al. Chapter 1: AUA guideline on management of staghorn calculi: diagnosis and treatment recommendations. J Urol. 2005;173:1991-2000.
13. Vicentini FC, Gomes CM, Danilovic A, Neto EA, Mazzucchi E, Srougi M. Percutaneous nephrolithotomy: current concepts. Indian J Urol. 2009;25(1):4.