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Research

Supine Mini- Percutaneous Nephrolithotripsy (Mini PCNL) for Renal Stones 0.5 – 2 CM in Pediatric Age Group: New Experience of TBRI

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ABSTRACT

Objective

To establish the new experience as well as to evaluate the safety and efficacy of mini percutaneous nephrolithotripsy (mini PCNL) in treatment of kidney stones 0.5-2 cm in pediatric age group.

Patients and Methods

Between December 2018 and October 2020 seventeen patients admitted to the Urology Department, presented with renal pelvis or calyceal stone (5-20 mm) were enlisted for mini PCNL. Achieving success of the technique is considered when stone free or radiologically insignificant residual fragments <4mm.

Results

The demographic data in this study is comparable with those in adults age group regarding the stone size with no statistical significance. Meanwhile, the operative time was 59.71 ± 19.44 min , and Fluoroscopy times had mean of 8.11 ± 2.05 min. The stone free rate was 96.2% in mini PCNL, one case of mini PCNL (5.9%) had significant bleeding and needed transfusion. One patient of mini PCNL (5.9%) had perforation in the renal pelvis which was resolved with insertion of Double J stent & nephrostomy.

Conclusion

Supine mini PCNL can be an effective and alternative option for treatment of renal stones 0.5-2 cm in pediatric age group. Supine mini PCNL has accepted operative and postoperative course. Larger numbers of patients will be more effective to confirm these results.

Keywords: *Pediatric; Mini percutaneous nephrolithotomy; Stone.*

INTRODUCTION

The renal stone has upgrading role in the morbidity and quality of life of patients and its prevalence is estimated to be about 10%.[1] Also, the recurrence of renal stones may be up to 50%.[2] The impact of recent technology on the kidney stone management has a great role especially the advancement of minimally invasive technique as Extracorporeal Shock Wave Lithotripsy (ESWL), Percutaneous Nephrolithotomy (PCNL), Retrograde Intra Renal Surgery (RIRS).[3] Percutaneous Nephrolithotomy (PCNL) has stand the test of time as an effective treatment for renal lithiasis, it is associated with high success rates, decreased morbidity, and fewer complications in relation to conventional renal stone surgeries. In ESWL ; the size, shape, and component of renal stones affect the stone free rate in comparison to PCNL which still has a great role,[3] and it has the upper hand in the treatment of large pelvic stone (15-20 mm or more), and in lower calyx stone less than 20 mm with unfavorable conditions for ESWL as recommended by guidelines of European association of urology.[4]

PCNL is also indicated when there is failure of ESWL, staghorn stones, and also in patients with hard stones (eg. Calcium monohydrate). PCNL morbidities are associated with the tract size.[5-7] Mini PCNL is begun when the technological advancement allows using instruments for a tract less than 20 Fr to extract renal stones which offers the same stone free rate in comparable with PCNL.[7-14] This work aims to evaluate the safety and efficacy of mini percutaneous nephrolithotripsy (mini PCNL) in treatment of kidney stones in children (15mm-20mm) in its longest diameter.

PATIENTS AND METHODS

Seventeen children presented to urology department, Theodor bilharz Research Institute, Giza, Egypt with either calyceal and/or pelvic kidney stone (0.5-20 mm) in the period between December 2019 and October 2020. Patient assessment required thorough full medical history, general, local examination, laboratory investigation (urinalysis, complete blood count, kidney function test, liver function test, and random blood glucose level), and radiological investigation in the form of computed tomography (CT). CT scan calculates the size of the stone in its longest diameter.

Parents and children patients were counseled and informed about the advantages, disadvantages, and possible complications of m PCNL . All parents received written informed consent before the surgery to be signed. Patients with history of kidney stones surgery or congenital anomalies were excluded from the study. Complete blood count, serum biochemistry, combined X ray of the urinay tract (XR KUB) and renal ultra sound were done to evaluate residual stone at the first postoperative day. The success of the technique is considered when status is stone-free or clinically insignificant residual fragments <4 mm. All demographic data are presented in [Table 1].

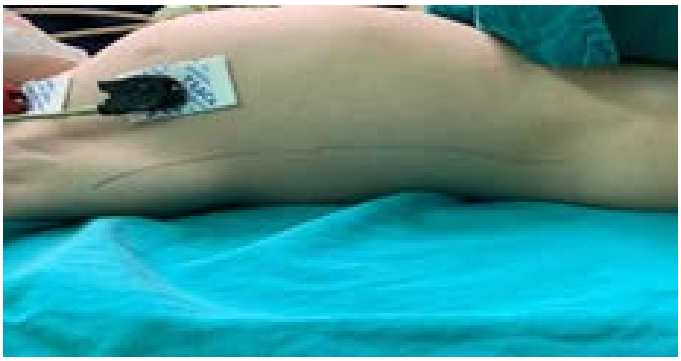
Table 1. Demographic data.

Age (Median/Range)	5 .6±6.91
Sex (M/F-N/%)	12/70% - 5/30%
BMI (Mean±SD)	15.76±9.34
Size (mm- Mean±SD)	17.43±5.2
Number (Median/Range)	1(1-2)
Density (Hounsfield Unit- Mean±SD)	730(±236)
Site	
Pelvis (n/%)	9 (55.1%)
Lower calyx (n/%)	14 (82.6 %)
Pelvi-calyceal (lower) (n/%)	2 (11.8%)
Laterality	
Right (n/%)	12(70%)
Left (n/%)	5(30%)

Operative Technique

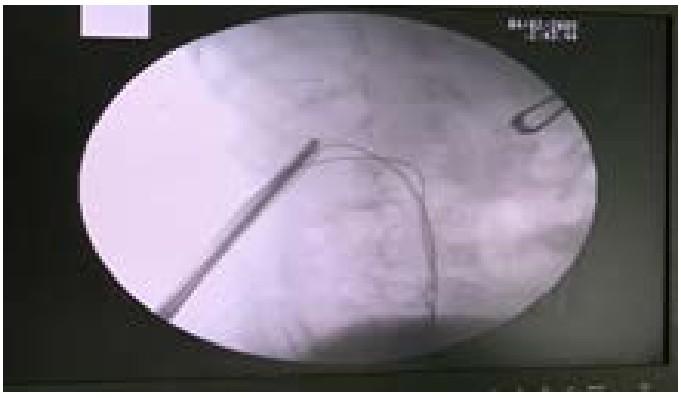
All patients received a prophylactic antibiotic before beginning of the procedure. The patient was in lithotomy position and a 4F retrograde ureteric catheter was placed in the renal pelvis, a small amount of radiographic contrast medium was flushed if needed to assure the ureteric catheter position. Then a Foley urethral catheter (8-10 Fr) was inserted and fixed with the ureteric catheter on the side of the thigh. We performed the procedure in supine position with the patient's side of the procedure at the edge of the operating table without putting any support under the flank, then sterilization of the skin by povidone-iodine 10% solution, then putting towels on the patient , then opacifying the collecting system by inserting the contrast medium through the ureteric catheter, the specific calyx was punctured by using a fluoroscopy C-arm at 0 and 30 degree by using 18 gauge puncture needle [Figure1], after assuring of being in the collecting system an angled tip, 0.035 inch diameter, 180 cm length, hydrophilic guidewire was inserted via puncture needle and it will be better to go through the ureter to the bladder.

Figure 1. Patient position



The Teflon dilators 12 Fr then 14 Fr were used to dilate the track. The 14 Fr metal sheath was then passed over the 14 F dilator, 14 Fr dilator is removed after assuring of the sheath inside the collecting system under fluoroscopy. This metal sheath 14 F has a sideway for connection with suction system which facilitate retrieval of gravels through the procedure. Stones were fragmented using 12Fr RZ nephroscope and by a holmium: YAG laser (Lisa; Sphinx 30 W, Katlenburg University, Germany) (272µ caliber fiber), and removal of the fragments by using the stone grasper and also by suction through the side way of the metal sheath. At the end of the maneuver in some cases (12 out of 17 patients) we keep the ureteric in place together with insertion of 12ch nephrostomy tube, in the remaining 5 cases we replaced the ureteric catheter by 4.8 ch double J stent [Figure2].

Figure 2. Renal dilation



RESULTS

The data in this study included 17 patients (12 male and 5 female) with a renal pelvis or calyceal stone. The Mean of age was 5 .6±6.91 years. 12 patients (70.5%) had right renal stones & 5 patients (29.5%) left ones. Body Mass Index (BMI) was 15.76±9.34 kg/m2 . The lower calyx stones were in 14 (82.6 %) patients & 9 (55.1%) patients in pelvis ,

while stones in lower calyx and pelvis were in 2 (11.8%) patients, Mean stone size was 17.43±5.2mm, and mean density was 730(±236) . Mean operative time was 59.71±19.44 min, while Fluoroscopy times had mean of 8.11±2.05 min We also observed that mean preoperative hemoglobin was 12.74±0.97 g/dL (11.5-14.5) g/dL & mean postoperative hemoglobin was 12.03±1.0 g/dL .The hospital stay was 1.41±0.46. The stone free rate was 96.2%. Only one case of m PCNL (5.9%) had significant bleeding and needs one-unit blood to be transfused with no statistical significance. One patient of mini PCNL (5.9%) had renal pelvic perforation and extravasation which was a small perforation and resolved with Double J stent and conservative measures, nephrostomy tube was inserted in both cases [Table2].

Table 2. Results.

Operative Time (minutes-Mean±SD)	59.71(±19.44)
Blood Loss (cc-Mean±SD)	110(±12)
Aborted Procedure (N/%)	0
Conversion (N/%)	-
Stone migration (N/%)	-
Stents ((N/%)	
JJ stent (N/%)	1(3.9%)
Ureteric catheter (N/%)	16 (96.2%)
SFRs (N/%)	16 (96.2%)
Pelvic (n/%)	0
Pelvic & calyceal	0
Lower calyceal (n/%)	1(3.9%)

DISCUSSION

KNowadays the technology helps the urologists by providing modern, highly advanced instruments to make treatment modalities safer and more efficient. Both American and European practice guidelines recommended PCNL as primay treatment for large renal stones.[15-17]

Mini PCNL has been proved safe and effective, in 2012, Yan et al. showed that stone free rate in preschool children with single renal stone <20mm treated by mini-PCNL is better than those with more than 2 stones or larger than 20mm.[18] After that Pei lu et al., 2017 showed that using PCNL for treatment of renal stones in children in comparison to RIRS has a higher stone free rate and no difference in operative time and complication rate.[19] Meanwhile Hyams et al. 2010 recorded 83% residual stones <4 mm in 120 patients treated with RIRS for renal stones 20-30 mm and the complication rate was 6.7%.[20]

In 2014 Giusti et al., the stone free rate was 87.7% in total number of 162 patients with average stone diameter 20.7±6 mm treated by RIRS which considered safe and effective.[21] By comparing the complication rate of mini PCNL and RIRS we will have a lower complication rate in RIRS than in mini-PCNL, however, the morbidity results like hemorrhage, pain and fever of both mini-PCNL and standard PCNL are similar and not common to be faced.[22,23]

Stone size was shown to be an important prognostic factor for the success of mini PCNL, in our study data mean stone size was 17±43mm this was equal to what was published by Fayad et al in 2017,[24] yet this was smaller to what Zengin K et al, and Koyuncu H et al worked on. [25-26] This relatively small stone size may be the reason of high stone free rate we achieved in comparison to other studies SFR, Zengin K et al.[25], 2015 reported 95.5% SFR, Koyuncu H et al,[26] 2015 showed SFR 96.1%, and Fayad A, S et al 2017 who worked on an equal mean stone size reported 92.72 % SFR.

The operative time conducted in many studies as Zengin K et al,[25] 2015 showed mean operative time 63 (min) in mini PCNL, Also Koyuncu H et al,[26] 2015 study reported mean operative time 62.5±20.67 for mini PCNL & Fayad et al,[24] 2017 showed a relatively longer operating time was 71.66 (10.36) in mini PCNL. In a metaanalysis comparing mini PCNL to RIRS, Hongyang, et al, [27,28] 2017 reported shorter operative time of mini PCNL in relation to RIRS. In our study mean operative time was 59.7±19.44 mini PCNL, which was shorter than other stidies(24-26), and may be related to smaller stone size in our study group.

Zengin K et al.[25] 2015 repoted mean hospital stay of 2.3 day in mini PCNL confirmed by Koyuncu H et al,[26] 2015 who showed a mean of 2.4±0.49 day; these were longer than our mean hospital stay which was reported to be 1.41±0.46 day.

We reported minor intraoperative complications in the form of one case of m PCNL (5.9%) with significant bleeding for which one unit blood was transfused, one patient of m PCNL (5.9%) with renal pelvic perforation and extravasation which was a small perforation and resolved with Double J stent, and nephrostomy tube. In our study complications assessed using the modified Clavien grading System which showed ; Grade 1: one case, grade 2: one case, grade 3A: one case grade 3B , this was better than what was reported by Zengin K et al.[25] 2015 which reported; Grade 1: 5 cases , grade 2: 3 cases , grade 3A : one case also grade 3B: one case also 0 in grade 4 & 5.

CONCLUSION

Mini PCNL can be an effective and alternative option for treatment of renal stones 0.5-2 cm in pediatric age group, Mini PCNL has more operative and postoperative complications but with high SFR. So multicentric studies with larger numbers of patients will be more effective to confirm these results.

CONFLICTS OF INTEREST

None.

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