Percutaneous Nephrolithotomy is Safe and Efficient when Performed on Early Adolescents with Adult-Sized Tools

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ABSTRACT

Aim: To report our experience of percutaneous nephrolithotomy using adult size instruments in young adolescents.

Study design: Retrospective case series

Place and duration of study: Department of Urology, Isra University Hospital Hyderabad between 1st January 2006 and December 2016.

Methodology: Twenty five adolescents underwent percutaneous nephrolithotomy were enrolled. The records of patients between the ages of 10 and 15 years underwent percutaneous nephrolithotomy at our institute was examined. The percutaneous nephrolithotomy was performed using a 24-Fr nephroscope. Stone burden and location were reviewed. Stone clearance was reviewed after the surgery. Renal units with <4mm residual stone on postoperative imaging were considered stone free.

Results: Mean age of patients was 12±2 yrs. Extracorporeal Shock wave Lithotripsy (ESWL) was required in 4 patients and one patient had retrograde intrarenal surgery (RIRS) for residual stones. The total percentage of stones removed was 84% (21/25). One patient in our group had factor VII deficiency, another had a kidney with a horseshoe shape, and a third had post-pyelolithotomy residual stones. Three patients needed blood transfusions, and one patient experienced transitory urine leakage for more than 12 hours. There were no complications that required medical or surgical attention.

Conclusion: Percutaneous nephrolithotomy in young adolescents is safe and effective. Adult size instruments can be used safely for percutaneous nephrolithotomy in this group of patients.

Keywords: Percutaneous nephrolithotomy (PCNL), Adolescents, Nephrolithiasis

INTRODUCTION

Development of two treatment modalities during 1980s has revolutionized surgical management of nephrolithiasis. The first was extracorporeal shock wave lithotripsy, reported by Chaussy in 1980[1]. Although, nephroscopy was first described by Rupel and Brown in 1941 but actual development of endourological removal of stone percutaneously happened during the late 1980s and early 1990s[2]. Since the advent of ESWL and PCNL, open surgery has become almost obsolete for renal stone removal. However, there are still specific indications for open surgery for example skeletal deformities such as severe kyphoscoliosis, which precludes a percutaneous approach or ESWL. In some parts of the world, unavailability of expertise and instruments also becomes a hindrance[3].

Nephrolithiasis in adolescents represents a special cohort. The incidence of nephrolithiasis in children is rising[4] and there has been a shift in the age group experiencing first stone episode. In a nationwide survey from Japan, the annual incidence (per 100,000) of first stone episode in patients 10-19 years of age, shifted from 11 to 17.7 between 1965 and 2005[5]. This translates into fact that more children now present for surgical removal of nephrolithiasis.

Although PCNL is considered the gold standard for large stone in adults, its use in children is still limited, mainly attributable to two factors. Firstly, the smaller organ in children becomes an important consideration when selecting the instruments for PCNL[6]. In western world the rate of open procedure for pediatric stone disease has dropped significantly, which parallels the development of miniaturized endoscopic instruments. In our part of the world, the availability of such instrument is often cited as a limitation[7]. Rizvi et al[8] from Sindh institute of urology reported in their series of approximately four thousand interventions for stone in children that 70% were minimally invasive and 30% were open surgeries. Second, adolescents often present to a pediatric surgeon who are mostly trained in open surgical technique with little exposure of endourology.

RESULTS

Most of the patients presented with flank pain 13 but hematuria 4 and febrile UTI 4 were not uncommon presentations in these children. The mean duration of symptoms was around one year (1±2.2 years). One patient had a horseshoe kidney, one had factor VII deficiency, and one had post-pyelolithotomy residual stones. The patient and stone related factors are given in table 1. We managed all of our patients with a single lower pole puncture, except two patients who required an additional mid-pole puncture to achieve stone clearance. We performed serial dilatation with metallic dilators in all of our patients. For 24-Fr nephroscope, we used a 26-Fr sheath. In three children, 28-Fr Amplatz sheath was used. In terms of efficacy, the initial stone free rate i.e. stone cleared with PCNL alone was 72% (18/25), whereas four patients required ancillary procedure ESWL, and one patient required
retrograde intrarenal surgery (RIRS) to achieve stone clearance.

The overall stone clearance rate after ancillary procedures was 21 % (84%) [Table 2]. In terms of safety, we encountered four Grade I UK Class complications. Transfusion was required in two patients. One patient had urinary leakage of more than 24 hours duration, which settled with conservative management. One patient had perinephric hematoma detected on ultrasound performed for postoperative fever and this was also managed conservatively. No complication requiring surgical/radiological intervention was encountered (Table 1).

### Table 1: Patient and stone related factors

| Mean age | 12±2 yrs. |
| Mean weight | 35±1.78 Kg |
| Mean Height | 149±4.2 cm |
| Mean stone diameter | 3.24 cm (Range 2.1-5.2 cm) |

### Stone location

| Pelvis | 17(68%) |
| Upper pole | 1(4%) |
| Lower pole | 6(24%) |
| Upper ureter | 1(4%) |

We avoided upper pole puncture in these small children because of concern regarding increased respiratory complications with upper pole puncture using larger instruments. Although safety of upper pole puncture is well established,

We used 26Fr amplatz sheath in all but two of our patients. The selection of amplatz sheath size is based upon the size of the stone, as larger stone fragments are more efficiently retrieved with larger stone, as larger stone fragments are more efficiently retrieved with larger stone, as larger stone fragments are more efficiently retrieved with larger stone, as larger stone fragments are more efficiently retrieved with larger stone, as larger stone fragments are more efficiently retrieved with larger stone, as larger stone fragments are more efficiently retrieved with larger stone, as larger stone fragments are more efficiently retrieved with larger stone, as larger stone fragments are more efficiently retrieved with larger stone. In a series of 60 renal units, cortical defects on 99mTc-DMSA scan done 4-6 weeks postoperatively, the site of defect corresponded to the access tract in only 3 patients. The risk of clinically significant renal scarring in pediatric patients subjected to PCNL is small. Dewa et al.

Secondly, there is increasing awareness of renal damage caused by puncture and dilatation of renal parenchyma which led to usage of smaller and smaller instruments. In a series of 60 renal units, cortical defects on 99mTc-DMSA scan done 4-6 weeks postoperatively, the site of defect corresponded to the access tract in only 3 patients. The risk of clinically significant renal scarring in pediatric patients subjected to PCNL is small. Dewa et al.

### DISCUSSION

Adolescents are defined by WHO as young people between the age of 10 and 19 years. The clinical presentation of renal stones in these young patients is a combination of presentation in adults (e.g. flank pain, hematuria) and children (febrile illness). A mean stone diameter of >3cm in our series is indicative of our high threshold for subjecting these young children to invasive procedure like PCNL as opposed to ESWL. We prefer ESWL for renal stones of up to 2.0 cm specially if anatomy in favorable in these young patients as per current standard practice.

Our cohort included some patients which traditionally are considered relative contraindication to percutaneous endourological approach. One such contraindication is uncorrected coagulopathy, the key word here being “uncorrected.” We managed one patient with Factor VII deficiency under Factor VII cover according to hematologist’s advice. We had one patient with horseshoe kidney and one who underwent PCNL using equipment designed for adults. With reasonable safety, stone clearance rates comparable to adult PCNL can be attained.

Unavailability of miniaturized instruments should not be considered a contraindication to percutaneous approach. There are no more considered a contraindication to percutaneous approach. There is increasing experience in dealing with nephrolithiasis in such technically challenging cases, for both adult and pediatric patients.

Since we retrospectively reviewed the children, we only were able to record major complications requiring intervention and minor complications e.g. postoperative fever were not recorded. Also we did not quantify change in renal function in these patients as preoperative serum creatinine values were not always available. We have limited our study to patients above 10 years of age though others have shown that PCNL can be done safely in even preschool children. Whether these smaller children can also be operated using adult size instrument remain to be determined.

### CONCLUSION

PCNL can be performed on a few carefully chosen early teenagers using equipment designed for adults. With reasonable safety, stone clearance rates comparable to adult PCNL can be attained. Unavailability of miniaturized instruments should not be considered a contraindication to PCNL in these young patients.

### Conflict of interest: Nil

### REFERENCES