

## Research Article

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# Percutaneous Nephrolithotomy in Pediatric age Group: Our Experience

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## Introduction

Pediatric urolithiasis, although rare, is increasing in incidence throughout the world [1, 2]. The majority of the stones affect the upper urinary tract and most studies have revealed a higher prevalence in male patients [1, 3, 4]. Pediatric urolithiasis is usually complex and often related to underlying metabolic or renal anatomical abnormalities associated with high recurrence rates [1].

**Introduction:** Pediatric urolithiasis is an uncommon disease with incidence varying widely throughout the world. We present our experience in pediatric PCNL in 20 pediatric patients with urolithiasis.

**Materials and Methods:** Case records of all patients under 14 years of age who presented with urolithiasis from 2016 March to February 2017 were retrospectively reviewed and analyzed with respect to demographic details, clinical presentation, stone characteristics, PCNL puncture site, number, stone clearance, ancillary procedures used, complications, and follow-up status of the children. Associated biochemical abnormalities were also reviewed.

**Results:** There were 25 renal units in 20 patients (5 had bilateral stones). The mean age at presentation was 8.4 years. There were 15 males and 5 females. The most common presenting symptom was flank pain (n=19/20). There were solitary stones in 17 renal units: 2 stones in 6 renal units and multiple stones in 2 renal units. The average stone size was 1.5cm. Four patients had staghorn calculi. Five patients required two punctures of whom 3 had bilateral disease and 2 had staghorn calculi. Sheath used ranged from 18Fr to 22Fr. The nephrostomy tube and DJ stent were kept in all patients. The duration of the procedure at a single site ranged from 45 minutes to 75 minutes. Complete clearance was achieved in 19 patients while one patient required bilateral URS. Three patients had mild fever post-operatively. None of the patients required blood transfusion. Hypocalcaemia was detected in 7 patients.

**Conclusions:** PCNL is safe and effective for treating urolithiasis in children.

**Keywords:** PCNL; Urolithiasis; Pediatric.

**Running Title:** Percutaneous Nephrolithotomy in children

The management of pediatric urolithiasis has changed over the past decades from open surgery to extracorporeal shock wave lithotripsy (ESWL) in the 1980s to percutaneous nephrolithotomy (PCNL) and miniperc (PCNL using small instruments). PCNL has revolutionized the treatment of pediatric nephrolithiasis. We describe our experience with pediatric PCNL at a tertiary center.

## Materials and Methods

The case records of all patients under 14 years of age who presented with urolithiasis over a period of 1 year from March 2016 to February 2017 were retrospectively reviewed. All patients were admitted and evaluated by blood tests, radiological work-up including x-rays, ultrasonography (USG), and computed tomography and stone analysis if necessary.

The demographic characteristics, pre- and post-operative management details, and details of surgery and follow-up were recorded. The size, location, and number of stones were recorded along with the technique used to retrieve the stones were recorded. The surgical details included the PCNL puncture site, number, stone clearance, ancillary procedures, and complications. The associated biochemical abnormalities were also reviewed.

The technique for PCNL is as follows: under general anesthesia, the kidney is punctured under fluoroscopic guidance; the tract dilated with metal dilators (18 Fr to 22 Fr) and an Amplatz sheath positioned. Then, a slender nephroscope is introduced and the stones are extracted using grasper forceps, with or without ultrasonic disintegration, as indicated. At the end of the procedure, a nephrostomy tube is placed to drain the kidney. Prophylactic intravenous antibiotics were given to all the patients.

Follow-up data were recorded with regard to the most up-to-date stone status and need for second surgery and recurrence. The follow-up was initially performed as a joint care between the urologist and nephrologist. Once the patient was stone free, the follow-up care was provided by the nephrologist.

## Results

There were 25 renal units in 20 patients (5 had bilateral stones). The mean age at presentation was 8.4 years (range: 4 years to 13 years). There were 15 male and 5 female patients. The most common presenting symptom was flank pain (n=19/20). Six patients had a previous history of urological procedure for their stone disease. Four patients had a history of inadequate water intake and six patients had a low calcium intake. Pre-operative serum creatinine was elevated in 1 patient only.

There were solitary stones in 17 renal units: two stones in 6 renal units and multiple stones in 2 renal units. The average stone size was 1.5cm (range: 1.1cm to 2.2cm). Four patients had

staghorn calculi. In fifteen patients, a single puncture was required to achieve stone clearance. Five patients required two punctures of whom 3 had bilateral disease and 2 had 21 staghorn calculi. The nephrostomy tube and DJ stent were kept in all patients. One patient required bilateral uretero-renaloscopy (URS). All patients were stone free on follow-up. There were no recurrences.

Duration of procedure at a single site ranged from 45 minutes to 75 minutes. Clearance was achieved in all patients. Post-operative period was uneventful in all patients except for mild fever seen in three patients. There were no complications. None of the patients required blood transfusion. The patient with raised pre-operative creatinine had his serum creatinine normalized after the procedure.

Stone analysis was done in seven patients. Calcium oxalate stones were found in 5 patients. The remaining 2 patients had mixed and uric acid stones each. Hypocalcaemia was detected in seven patients.

## Discussion

Pediatric urolithiasis is uncommon and is often associated with metabolic disorders or anatomical abnormalities [8-12]. In our study, 7 patients (35%) had associated hypocalcemia, 1 patient (5%) had urinary tract infection, and none had anatomical abnormalities. This is in contrast with some studies reporting anatomical abnormalities in 20-44% of the patients [8, 10, 12].

PCNL was first introduced in 1976 [13, 14]. This technique has improved markedly since its introduction due to technological advances in instruments [13]. With the availability of smaller instruments and ultrasound guidance, PCNL is relatively safe in experienced hands. PCNL is performed in children as young as 19 months [15, 16]. Although invasive, this procedure has been reported to achieve excellent stone free rates of about 90% (ranging from 67 to 100%) [15, 17]. The reported complications of PCNL include postoperative fever (30%) and bleeding; the risk for blood transfusions is usually very low, ranging from 0% to 23.9% [15, 17].

PCNL was first reported to be feasible as a one-stage procedure by Wickham et al [13, 18]. Several studies have shown that PCNL can be performed safely in children with a good stone clearance (58–93%) and minimal complication (0–10%) rates [1]. Samad et al reported the largest pediatric PCNL experience in 188 patients using a 22Fr tract with an overall clearance rate of 76% and

complication rate of 5% [19]. Aron et al reported pediatric PCNL using multiple tracts with a stone clearance rate of 89% and no complications [20].

At our center, our aim is to provide one-puncture primary PCNL under fluoroscopic guidance with a single dilated tract to achieve complete stone clearance with minimal renal tissue injury. A cylindrical nephroscope is used in our center. In this study, a single puncture was required in 15 patients (75%) while five patients (25%) required two punctures of whom 3 had bilateral disease and 2 had staghorn calculus. Complete clearance was achieved in 19 patients (95%) and only one patient required URS. No conversion to open procedure was required in any of the patients.

The duration of the procedure in this study was 45 minutes to 75 minutes, which is comparable to 89 minutes reported by Mahmud et al [13]. There were no complications in our study except for fever in 3 patients (15%) that resolved by conservative management.

A smaller caliber nephroscope is believed to be less injurious to nephrons [13, 21]. Jackman et al used a 7 F rigid cystoscope over an 11 F 'peel-away' vascular access sheath [13, 22]. As for the instrument size and complications, Bilen et al, Unsal et al, and Guven et al reported equal success rates with both larger and smaller caliber instruments although the rate of bleeding was higher in patients receiving larger caliber instruments [1, 6, 23, 24]. We used an 18.5 Fr nephroscope and the mean drop in hemoglobin ranged from 1 to 1.5 g/dl, indicating no need for blood transfusion.

Animal models have shown that the PCNL tract size has no impact on the renal function and the creation of nephrostomy tract causes very little damage when compared with the overall renal volume [1, 25]. Mor et al reported no significant loss of renal function on post-operative renal isotope scan after using a tract dilated to 24-26 Fr [1, 26]. In this study, post-operative renal isotope scan was not performed routinely and was done only in patients who had post-operative UTI.

## Conclusions

PCNL is a safe and effective procedure for management of pediatric urolithiasis. In this study, a slender nephroscope was used with a single tract dilation and the results showed good clearance rates with minimal complications.

## Conflict of Interest

Authors declare that they have no conflicts of interest.

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