Review of percutaneous nephrolithotomy in children below 12 years old in Jahrom hospital, during 2010-2014

Ali Reza Yousefi
Reza Inaloo

Department of Urology, Jahrom University of Medical Sciences, Jahrom, Iran.

Corresponding author:
Reza Inaloo,
Department of Urology,
Jahrom University of medical sciences,
Jahrom, Iran Tel: +989173130056
Email: rezainaloo@yahoo.com

Abstract

Introduction: Although, renal stone isn't frequent in children, but Percutaneous Nephrolithotomy can be used in children if indicated. Percutaneous Nephrolithotomy in children is different from adults, thus we review some children who underwent Percutaneous Nephrolithotomy and review them for complications and stone free rate.

Material and Methods: This study was done using descriptive cross-sectional method on 43 cases under 12 years old who had renal stone and were treated by Percutaneous Nephrolithotomy in Jahrom Peymanieh hospital. All cases had medical records. Having a renal stone larger than 2cm, multiple stone, no response to extra corporeal shock wave lithotripsy were a criteria for patients below 12 years old to be involved in the study and to be cured by Percutaneous Nephrolithotomy operation. Patient's data was collected with a research made questionnaire.Data was investigated in a level of descriptive statistics via statistics software (SPSS, Edition14) in which the average and deviation of criteria and qualitative variables from frequency percentage and frequency was used in quantitative variables of descriptive reports.

Results: From 43 patients 22 patients (51.1%) were male and 21 patients (48.8%) were female. The patients were aged from 7 months to 11 years old. The stone size ranged from 1cm to 2.5 cm. The number of stones in 42 patients had been recorded. Among these 45.2 percent of them had one stone and 33.3 percent had two. The stone free rate was 85%. The average of hospital stay was 31.11±12.56 hours. The longest time was 24 and 48 hour and that respectively included 33.3% and 26.2%. The complications were: (0%), Excessive bleeding which needed transfusion (0%), post op convulsion (9.5%), and organ injury (0%).

Discussion: Percutaneous stone therapy-related hemorrhage requires a blood transfusion (11%-14%), and an increased risk of kidney loss. In this study, the stones were removed completely with minimal injury to renal tissue. PCNL has a better stone clearance rate and is cost-effective. PCNL has a clearance rate of 100% when it was combined with ESWL.

Key words: Percutaneous Nephrolithotomy, Renal stone, Pediatrics

Please cite this article as: Ali Reza Yousefi , Reza Inaloo . Review of percutaneous nephrolithotomy in children below 12 years old in Jahrom hospital, during 2010-2014. *World Family Medicine.* 2017; 15(9):135-141. DOI: 10.5742/MEWFM.2017.93113

Introduction

Nephrolithiasis is a common clinical disorder affecting up to 5% of the general population in the USA [1]. The prevalence of renal stone disease has been rising in both sexes, being estimated that about 5% of American women and 12% of men will develop a kidney stone at some time in their life [2]. Nevertheless, in certain areas of the world, as in the Middle East, the lifetime risk appears to be even higher [3]. There has been heightened awareness of renal stone disease in children as well [4]. Recurrence rates of 50% after 10 years and 75% after 20 years have been reported [5،6]. Clinical manifestations are characterized by lumbar pain of sudden onset [the location of pain depends on the location of the stone in the urinary tract] which may be accompanied by nausea and vomiting, and gross or microscopic hematuria Diagnosis of renal stone in the acute setting is beyond the scope of the present update but in brief, is represented by urinalysis and imaging. Urinalysis often reveals hematuria but the latter is absent in approximately 9% of cases [3]. Crystal Luria is occasional and the presence of leucocyturia may suggest associated urinary tract infection. Unenhanced helical computed tomography [CT] scan, the most sensitive and specific radiographic test, is becoming the diagnostic procedure of choice to confirm the presence of kidney and especially of ureteral stones [4].Renal colic must be differentiated from musculoskeletal pain, herpes zoster, pyelonephritis, appendicitis, diverticulitis, acute cholecystitis, gynecologic disease, ureteral stricture of obstruction due to blood clot, and polycystic kidney disease [5]. Stone formation usually results from an imbalance between factors that promote urinary crystallization, and those that inhibit crystal formation and growth [5]. Urinary tract stone disease is likely caused by 2 basic phenomena. The first phenomenon is supersaturating of the urine by stone forming constituents, including calcium, oxalate, and uric acid. Crystals or foreign bodies can act as nidi, upon which ions from the supersaturated urine form microscopic crystalline structures. The overwhelming majority of renal calculi contain calcium [6]. Other, less frequent stone types include cysteine, ammonium acid urate, xanthine, dihydroxyadenine, and various rare stones related to precipitation of medications in the urinary tract. Stones of the upper urinary tract are more common in the United Stated than in the rest of the world. Roughly 2 million patients present on an outpatient basis with stone disease each year in the United States, which is a 40% increase from 1994[12]. The incidence of urinary tract stone disease in developed countries is similar to that in the United States. Stone disease is rare in only a few areas, such as Greenland and the coastal areas of Japan. In developing countries, bladder calculi are more common than upper urinary tract calculi; the opposite is true in developed countries. These differences are believed to be diet-related [13]. The morbidity of urinary tract calculi is primarily due to obstruction with its associated pain, although non obstructing calculi can still produce considerable discomfort. Stone- induced hematuria is frightening to the patient but is rarely dangerous by itself. The most morbid and potentially dangerous aspect of stone disease is the combination of obstruction and upper urinary tract infection. Stones are more common in hot and dry areas and diet heredity also appears to be a factor. Stone disease is much more frequent in whites. In general, urolithiasis is more common in males. Stone due to discrete metabolic/hormonal defects, cystinuria, hyperparathyroidism and stone disease in children are equally prevalent between the sexes. Stones due to infection [struite calculi] are more common in women than in men. Most urinary calculi develop in patients aged 20-49 years. Patients in whom multiple recurrent stone forms usually develop their first stones while in their second or third decade of life. An initial stone attack after age 50 years is relatively uncommon [14]. Patients with urinary calculi may report pain, infection, or hematuria. Small non obstructing stones in the kidneys only occasionally cause symptoms. The passage of stones into the ureter with subsequent acute obstruction, proximal urinary tract dilation, and spasm is associated with classic renal colic. Renal colic is characterized by undulating cramps and severe pain and is often associated with nausea and vomiting. As the stone travels through the ureter, the pain moves from the flank to the upper abdomen, then to the lower abdomen, down to the groin, and eventually to the scrotal or labial areas. Associated bladder irritative symptoms are common when the stone is located in the distal or intramural ureter. Patients with large renal stones known as stag horn calculi are often relatively asymptomatic. Asymptomatic bilateral obstruction, which is uncommon, manifests as symptoms of renal failure. Approximately 80% of kidney stones contain calcium, and the majority of them are composed primarily of calcium oxalate. Although most calcium oxalate stones contain some calcium phosphate, only 5% have hydroxyapatite of brushite as their main constituent and 10% contain some uric acid [15]. Evaluation of a renal stone patient starts with a detailed history focusing on occupation, dietary and lifestyle habits, previous use of medications, family predisposition, and history of recurrent urinary tract infection and underlying disorders that predisposes to nephrolithiasis [16].

Material and Methods

This study was done using descriptive-cross-sectional method on 43 patients below age of 12, who had been suffering from renal stone and were treated by use of PCNL operation (percutaneous Nephrolithomy procedures) at Jahrom Paymanieh hospital. All the patients had medical records. The study was conducted using a form which had been provided and completed by the surgeon. The patients who under went PCNL had renal stone larger than >2cm or multiple stones or no response to ESWL. The criteria for exiting from the study were age above 12 years old and renal stone smaller than 2cm. (The information was collected by the use of a form which had been provided and completed by the physician).The mentioned information in the form included: gender (sex), age, place of stone, kind of stone, number of stones, operation's side effects, the number of remained stones, number of hemoglobin after operation and time of hospitalization. (Admission in

hospital). This information was included in the questionnaire by observing the ethics and investigation committee's instructions of Iran's Ministry of Health. Names and details of participants were confident and each patient was given a numerical code. Finally the obtained information was investigated in a level of descriptive statistics via statistics software (SPSS, Edition14) in which the average and deviation of criteria and qualitative variables from frequency percentage and frequency was used in quantitative variables of descriptive reports.

Research Method:

At first, after general anesthesia, cystoscopy was done by (stortz 10F) in supine position. Then a urethral catheter (5F) was sent within involved kidney and fixed Foley catheter and then in prone position, nephrostomy needle was sent to inferior and posterior calyx by fluoroscopy.

After that, guidewire is sent into the kidney. Thus nephrostomy tract is dilated till 24F, and then Amplatz (24F) is sent into the kidney, and then nephroscopy was done (wolf 17F).Next lithotripsy was done by Swiss pneumatic lithoclast and stone fragments taken out from the kidney after checking for residual stones (by fluoroscopy), Nephrostomy (16F) was inserted and fixed and the operation was completed. If the operation was prolonged for prevention of hyponatremia, at the end Lasix (0.5 mg/kg) was prescribed. Because of using normal saline during the operation for irrigation, dilutional hyponatremia is produced, thus we check Na & K after the operation. Regarding the determined special objects, the results of the study are the following:

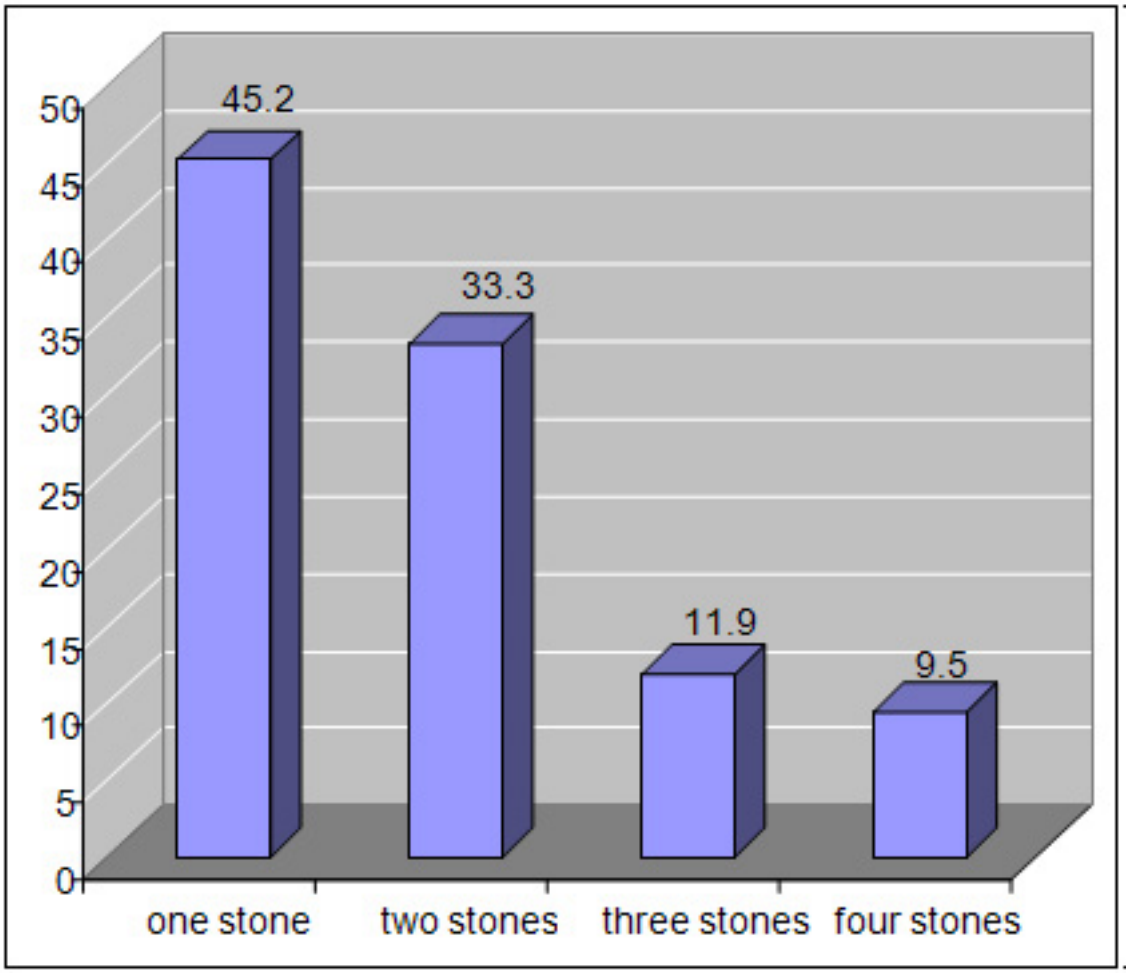
1. Number of stones: determining the number of stones in the kidney after PNCL operation in the children below 12 years old at Jahrom Paymanieh hospital's urology clinic, during 2010-2014.

Though the study was been done on 43 patients, the number of existent stones in 42 patients had been recorded. Among these people 44.2 percent of them had one stone and 33.6 percent had two. stones and 11.9 percent had three and 9.5 percent had 4. (Table 1, Figure 1)

Table 1: Frequency percent of number of stones

Number of stones	Frequency	Frequency percentage
1	19	45.2
2	14	33.3
3	5	11.9
4	4	9.5

Figure 1: Frequency percent of number of stones



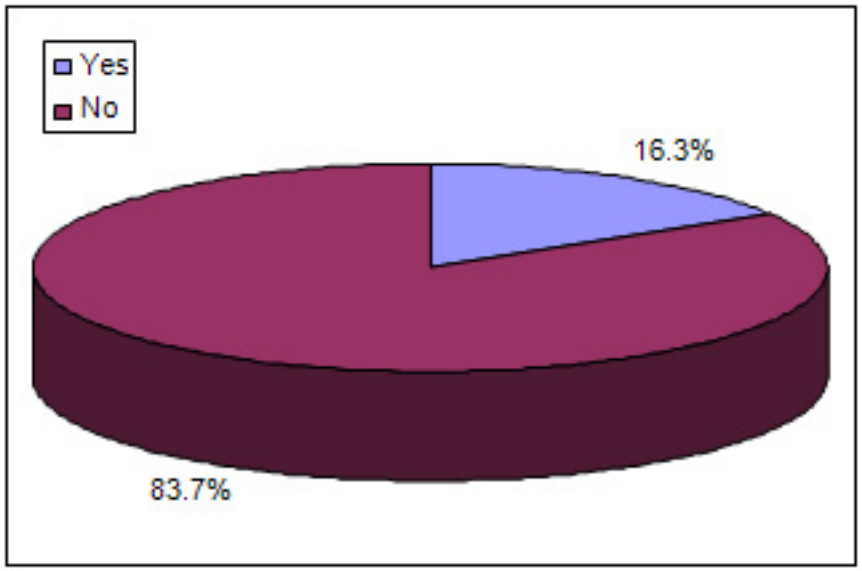
2. Residual stones: To determine the amount of remained stone after operation that was done in Jahrom Paymanieh hospital's urology clinic, during 2010-2014.

The stones were completely taken out from the kidney of 43 patients (85 percent of the population) and their operation was done successfully.

Table 2: Remained stones after operation

Distribution / Remained stone after operation	Absolute frequency	Relative frequency
Yes	14	33.3
No	29	66.7
Total	43	100

Figure 2: Relative Frequency of Residual stones

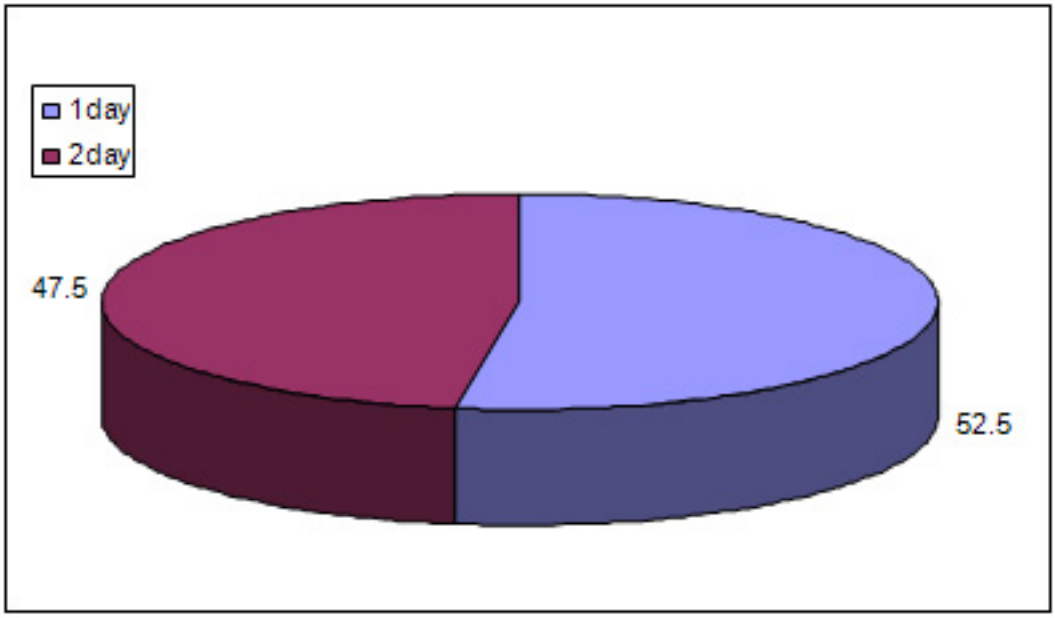


3. Hospital stay: determining the average time of hospitalization for children below 12 years old who were suffering from renal stone after PNCL operation at Jahrom Paymanieh hospital's urology clinic, during 2010-2014. The average time of hospitalization was 31.11±12.59 hours. The longest time was 24 and 48 hours that respectively included 33.3 and 26.2 percent.

Table 3: Hospital stay

Relative frequency	Absolute frequency	Hospitalization hours
1	1	2.4
12	1	2.4
14	1	2.4
15	1	2.4
16	1	2.4
18	1	2.4
20	1	2.4
23	1	2.4
24	14	33.3
36	9	21.4
48	11	26.2
Total:	43	100

Figure 3: Valid percent of hospitalization (days)



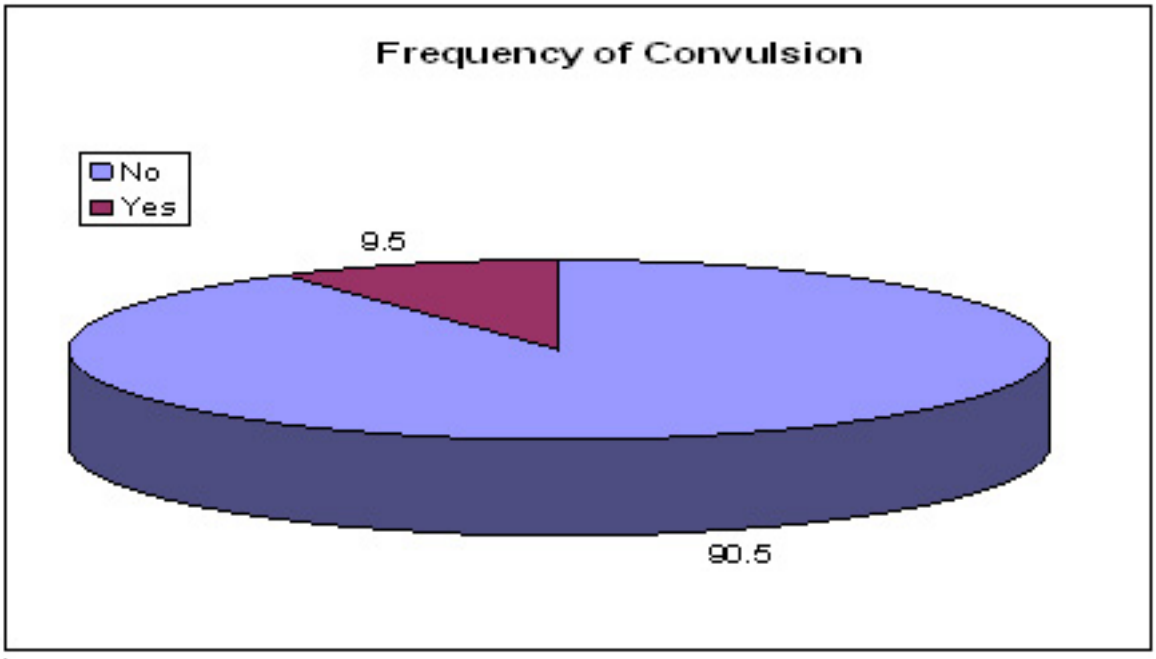
4. Side effects: To determine the PNCL operation's side effects in children below 12 years old at Jahrom Paymanieh hospital's urology clinic, during 2010-2014.

The PNCL operation's side effects were recorded for 42 of patients, infour patients this involved convulsion and 38 patients had no problems.

Table 4:

Distribution / Operation's stone effects	Absolute frequency	Relative frequency
No problem	38	90.5
Convulsion	4	9.5
Total	42	100

Figure 4



Discussion

Pediatric urolithiasis poses management challenges because of small kidney size, less knowledge about the long-term effects of newer modalities of treatment on kidneys and etiology of the stone. Shock wave lithotripsy is the treatment of choice for most small calculi, while PCNL or open surgery is reserved for larger stones or stones with anatomic abnormalities.Aim of treatment is complete clearance and treatment of the underlying cause. The first series on pediatric PCNL was published by Woodside et al claiming a100% stone free rate with no significant complications. They used standard dilatation technique. In series reported by Boddy et al" 90% stone free rate was achieved and after sequential dilatation 24 to 26 F sheath was used with no major complications. Segura has suggested the use of adult instruments in children. Desai et al (17),suggests limited tract dilatation < 21 F and use of pediatric instruments. The drawback with pediatric instruments is small instrument port, which necessitates use of small probes and forceps. This results in prolongation of operation time. Blood loss is a major complication of pediatric PCNL, which is directly related to tract size dilatation. Reduced incidence of major intra renal vessel injury using a pediatric nephroscope has been reported by Zanetti et al(6). It is believed that adult instruments may cause more bleeding and amplatz may be too big for the pediatric kidneys. We have been doing PCNL on pediatric patients since 1988 using adult instruments (Stortz) without any significant problem. Since 1994 this problem was taken care of in our series by using Wolf adult nephroscope inner sheath (20 F), which allowed placement of smaller amplatz sheath(2). More effective fragmentation of stone was achieved using adult size ultrasonic and pneumatic energy sources. The advantages of this technique are better visibility, quick, effective stone fragmentation and retrieval using adult size energy probes and stone graspers. One can avoid buying a separate pediatric set of instruments which may result in considerable cost saving for a department in a developing country. Since the advent of PCNL in 1976, the techniques have been greatly improved. Many medical centers have used adult-sized nephroscopes in children(11). But percutaneous stone therapy-related hemorrhage requires a blood transfusion (11%-14%), and an increased risk of kidney loss. Therefore, conventional percutaneous nephrolithotomy is not justified as the primary form of urinary stone treatment for smaller lower pole concernments, although it is recommended as an effective method in children. Percutaneous nephrolithotomy using ureter scope and pneumatic intra corporeal lithotripsy in children was introduced to our hospital in 2002(18). In this study, the stones were removed completely with minimal injury to renal tissue, while retrieving large fragments quickly. The duration of the procedure was 75 minutes. The level of hemoglobin decreased by 14 g/L on average. None of the patients received blood transfusion. To date, there has been only one recurrence of stone and no other complications have occurred. Traditional percutaneous nephrolithotomy uses a 30-Fr nephrostomy sheath for renal access. In order to reduce blood loss and absorption of irrigant, stone extraction may be performed when the established access tracts become mature. The recent development of smaller sheaths suggests that percutaneous nephrostomy tract formation can be performed with minimal injury to the involved renal parenchyma, thereby reducing the procedure-related morbidity. We used ureter scope and pneumatic intra corporeal lithotripsy in pediatric patients. The operating tract was small (12F-18F), therefore only 2 operations were discontinued because of greater blood loss in the process of dilatation, but the second operations were successful. During PCNL, the common mistake especially for stag horn in children is overdoing through a single tract, even when another tract is needed. Torqueing a rigid ureter scope against the pelvi-caliceal system to get to an inaccessible calix is the most important cause of bleeding during PCNL and is largely responsible for the increased rates of transfusion and extravasation. We believe that judiciously making multiple tracts does not significantly increase intraoperative complications and transfusion. Using multiple tracts when necessary avoids the excessive use of torque to gain entry into adjacent calices, which may cause infundibula tear and bleeding. In the present series, multiple tracts were used in 8 kidneys. As a result, better and faster clearance of large-volume stag horn calculi was achieved without significant increase in morbidity. PCNL has a better stone clearance rate and is cost-effective. It is characterized by convalescence compared with other modalities such as ESWL and open surgeries for removal of the stones. In our series, PCNL achieved a complete-clearance rate of 91%, and an overall clearance rate of 100% when it was combined with ESWL. In children with large renal stones (>3 cm), stag horn calculi (complete and partial), complex or multiple calculi, renal insufficiency, recurrent stones, and stones refractory to ESWL, PCNL is considered the treatment of choice. The use of a less traumatic 18-Fr access sheath is effective in children with large renal stones. A prerequisite for stone clearance is the establishment of optimal access to the collecting system of the kidney. Staging the procedure in selecting patients is very important to reduce the caliber of the percutaneous tract in children with non-dilated collecting system (19).

Conclusion

We can do PCNL in children if necessary. Doing and complications of PCNL in children is the same as in adults. But we assay convulsion after PCNL and do preventive methods before PCNL.

References

1. Jou YC, Cheng MC, Sheen JH, Lin CT, Chen PC. Cauterization of access tract for nephrostomy tube-free percutaneous nephrolithotomy. J Endourol. 2004 Aug;18(6):547-9.
2. Stamatelou KK, Francis ME, Jones CA, Nyberg LM, Urhan GC. Time trends in reported prevalence of kidney stones in the United States: 1976-1994. Kidney Int 2003;63(5):1817-23.
3. Moe OW. Kidney stones: Pathophysiology and medical management. Lancet 2006;367:333-44.
4. Pak CYC, Resnick MI, Preminger GM. Ethnic and geographic
diversity of stone disease. Urology 1997;50(4):504-7.
5. Heilberg IP, Boim MA, Schor N. Biochemical differences between stone formers and normal subjects. In: Segura J, Conort P, Khoury S, Pak C, Preminger GM, Tolley D (eds). Stone Disease (1st International Consultation on Stone Disease). Editions 21. France: Health Publications, 2003; pp. 61-4.
6. Trinchieri A, Ostini F, Nespoli R, Rovera F, Montanari E,
Zanetti G. A prospective study of recurrence rate and
risk factors for recurrence after a first renal stone. J Urol 1999;162(I):27-30.
7. Sutherland JW, Parks JH, Coe FL. Recurrence after a single renal stone in a community practice. Miner Electrolyte Metabl985;ll(4):267-9.
8. Li J, Kennedy D, Levine M, Kumar A, Mullen J. Absent hematuria and expensive computerized tomography:case characteristics of emergency urolithiasis. J Urol 2001; 165(3):782-4.
9. Abramson S, Walders N, Applegate KE, Gilkeson RC,
Robbin MR. Impact in the emergency department of unenhanced CT on diagnostic confidence and herapeutic efficacy in patients with suspected renal colic: a prospective survey. Am J Roentgenol 2000;175:1689-95.
10. Shokeir AA, Abdulmaaboud M. Prospective comparison of unenhanced helical computerized tomography and Doppler ultrasonography for the diagnosis of renal colic. J Urol 2001;165:1082-4.
11. Catalano O, Nunziata A, Altei F, Siani A. Suspected ureteral colic: primary helical CT versus selective helical CT after unenhanced radiography and sonography. Am J Roentgenol 2002;178:379-86.
12. Coe FL, Evan A, Worcester E. Kidney stone disease. J Clin (jfnvest 2005;115:2598-608.
13. Pearle MS, Calhoun EA, Curhan GC; Urologic diseases in America project: urolithiasis. J Urol. Mar 2005;173(3):848-57.
14. Webber R, Tolley D, Lingeman J. Kidney stones. Clin Evid. Dec 2005;(14): 1048-56.
15. Cooper JT, Stack GM, Cooper TP. Intensive medical management of ureteral calculi. Urology. Oct 1 2000;56(4):575-8.
16. Parks JH, Coward M, Coe FL. Correspondence between stone composition and urine supersaturation in nephrolithiasis. Kidney Int 1997;51(3):894-900.
17. Desai MR, Kukreja RA, Patel SH, Bapat SD. Percutaneous nephrolithotomy for complex pediatric renal calculus disease. J Endourol 2004;18:23-7.
18. Schuster TG, Russel KY, Bloom DA, Koo HP, Faerber GJ. Ureteroscopy for the treatment of urolithiasis in children. J UROL 2002;167:1813-6.
19. http://www.indianjurol.com/printariticle.asp?issn=0970-1591;year=2001,volume=18;i…. 2007/04/19.