

Kidney and Ureteral Calculi in a 5-Month-Old Infant: A Case of Ultra-Mini Percutaneous Nephrolithotomy

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ABSTRACT

Aim: Urolithiasis is rare in infancy, yet its incidence has been increasing in recent years, partly due to the widespread use of ultrasonography. Pediatric stone disease is characterized by higher recurrence rates than in adults, necessitating minimally invasive treatment approaches that minimize morbidity and preserve long-term renal function.

Case Presentation: We report the case of a 5-month-old male infant who presented with restlessness, fever, and anorexia, with a recent history of recurrent urinary tract infections. Imaging revealed left renal and right ureteral calculi. Right ureteral stones were treated via ureterorenoscopy (4.5 Fr ultra-thin ureteroscope) and Holmium:YAG laser lithotripsy with subsequent double-J stent placement. Renal stones, including a 1 cm lower calyceal and a 2 cm middle calyceal calculus, were managed using Ultra-Mini Percutaneous Nephrolithotomy (UmPNL) with a 9.5 Fr nephroscope, resulting in complete stone clearance. The total operative time was 90 minutes with a fluoroscopy duration of 32 seconds. No intra-operative or post-operative complications, bleeding, or fever were observed. The nephrostomy catheter was removed on post-operative day 1, the Foley catheter on day 2, and the patient was discharged uneventfully. Both ureteral stents were removed four weeks later under sedation.

Discussion: Pediatric stone disease in infants is associated with multifactorial etiologies including anatomical, metabolic, and infectious factors. Technical challenges are amplified in this population due to the small collecting system, fragile renal cortex, and narrow ureteral dimensions. Advances in miniaturized endoscopic instruments and the use of Holmium:YAG laser have significantly improved the safety and efficacy of ureteroscopic and percutaneous approaches in children. Compared with extracorporeal shock wave lithotripsy, percutaneous techniques offer higher single-session stone-free rates and eliminate the need for repeated anesthesia. Literature reports confirm the feasibility of percutaneous nephrolithotomy in infants when performed in experienced centers with appropriate equipment.

Conclusion: This case demonstrates that combined ureterorenoscopy and ultra-mini percutaneous nephrolithotomy can be safely and effectively performed in infants as young as 5 months, achieving complete stone clearance without complications. In high-volume centers with surgical expertise, such minimally invasive approaches represent a reliable and practical option for the management of infantile urolithiasis.

Keywords:

Ultra-Mini Percutaneous Nephrolithotomy (UmPNL), Stone disease, Ureterorenoscopy, Lithotripsy, Renal calculi.

Introduction

Stone disease is relatively rare in pediatric patients [1]. Although there are more reliable data on stone incidence in adult patients, the incidence of stone disease in the infant patient group is not clearly known. In recent years, an increase in the incidence of pediatric stone disease has been observed even in non-endemic regions [2-4]. The reason for this may be the increased use of urinary ultrasonography in children even with specific or nonspecific symptoms [4]. Therefore, urinary tract stones are being diagnosed in an increasing number of children and in younger age groups [5].

The possibility of recurrence of stone disease in the pediatric age group is higher than in adults [6]. In the pediatric patient

group, minimally invasive treatment options should be planned considering the miniature body structure, the possibility of stone recurrence and long-term complications [7]. In this case report, we present a 5-month-old patient who was brought to our clinic and the treatment we applied.

Case Report

A 5-month-old male infant was admitted with complaints of restlessness, fever and anorexia. He did not have any urologic pathology detected in the antenatal period. It was learned that he was diagnosed with urinary tract infection twice in the last two months and received treatment for this infection. Low dose non-contrast tomography was performed after ultrasonography showed shadowing compatible with renal calculi. Tomography revealed left renal calculi and right ureteral calculi (Figure 1). Ureterorenoscopy (URS) and ultra mini percutaneous nephrolithotomy (UmPNL) were planned. After pre-operative routine examinations and sterile urine culture, the patient was

entered through the urethra with a 4.5 Fr URS (Ultra-Thin Uretero-Renoscope 4.5/6.5 Fr; Richard Wolf GmbH, Knittlingen, Germany) in the lithotomy position under general anesthesia. A 0.035-inch sensor guide wire (Boston Scientific) was inserted through the right orifice. Two stones with a total size of 5 mm were removed with Holmium:YAG Laser (StoneLight; Minnetonka, MN, USA. Stone Light 30 Laser Therapy/272 micron fiber) and fragmented by dusting method. A 3 Fr 10 cm Double J stent (DJS) was applied under scopic guidance. Subsequently, a 3 Fr ureteral catheter was introduced through the left orifice. The upper end of the catheter was controlled in the kidney on the scope. The catheter was then fixed to a 6 Fr foley catheter and the patient was placed in the prone position. The calyceal system was accessed with a 9.5 Fr Nephroscope (12 cm long, Karl-Storz, Japan compact cystoscope) after 14 Fr dilatation with one shot technique (8) over a 0.035 inch sensor guide wire (Boston Scientific) (Figure 1). The 1 cm stone in the lower calyx and approximately 2 cm stone in the middle calyx were fragmented with Holmium:YAG Laser and removed from the body. A 3 Fr 10 cm DJS was performed antegradely under scopic guidance. 12 Fr feeding catheter was applied as nephrostomy. Antegrade pyelography was performed from the nephrostomy and the calcial system was checked and the procedure was terminated (Figure 1). There were no intraoperative and post-operative complications. The procedure time was 90 minutes and scopy time was 32 seconds. No hemoglobin decrease was observed in the follow-up of our patient. Our patient did not complain of fever and restlessness in the post-operative period. The nephrostomy catheter was withdrawn on the first post-operative day and wetting from the tract was monitored. Foley catheter was withdrawn on the second post-operative day. Our patient was discharged after no wetting from the nephrostomy tract. DJSs were removed 4 weeks later under sedation anesthesia.

Discussion

Kidney stones seen in the pediatric age group are usually anatomic, metabolic and infection-related. Stone disease is a rare condition in the infant patient group. Urinary system stones may be observed more frequently due to genetic

predisposition, anatomic malformations, nutritional conditions and climatic conditions [1]. It is not yet clear how early stone formation starts in the antenatal period, neonatal period or infancy [7]. The high recurrence rate in childhood makes it mandatory that the treatment to be chosen should be as minimally invasive as possible.

Technical developments in endourology should ensure miniaturization of endoscopic instruments without losing their effectiveness [5]. Miniaturization of endoscopic instruments has allowed an increase in the efficacy of treatment of urinary tract stones in young children [5]. The use of smaller caliber ureteroscopes may prevent possible complications. Therefore, it may reduce ureteral damage, bleeding or rupture and the need for post-operative double J stent placement [5]. In our case, we used 4.5 Fr ultrathin URS for ureteral calculi and UmpNL 9.5 Fr compact cystoscope as nephroscope for renal calculi for the reasons mentioned above.

Due to the small age of the patient population diagnosed with ureteral calculi, the provision of appropriate equipment that can be used in young children is one of the most important issues in terms of surgical success. Miniaturization of endoscopic instruments has increased the effectiveness of treatment of ureteral calculi in young children [5]. The most common cause of failure in pediatric ureteral calculi is narrow ureteral orifice and ureteral diameter [3,4]. It has been reported that complications such as mucosal injury, ureteral perforation, major bleeding and ureteral avulsion are less common with the use of small caliber URS [9,10]. The use of Holmium yag laser facilitates stone fragmentation and increases the effectiveness of ureteroscopic lithotripsy [11,12].

Extracorporeal Shock Wave Therapy (ESWL), flexible URS and PNL methods are used in renal stone surgery. The need for anesthesia during ESWL application in children and the need for reanesthesia in case of failure have nowadays relegated ESWL to the second plan in the infant age group [13]. With increasing technological advances and surgical experience, PNL is now a popular choice in this patient group. In our clinical practice, we prefer PNL in appropriate patients because of the need for anesthesia in both procedures, the high stone-free rate in PNL in

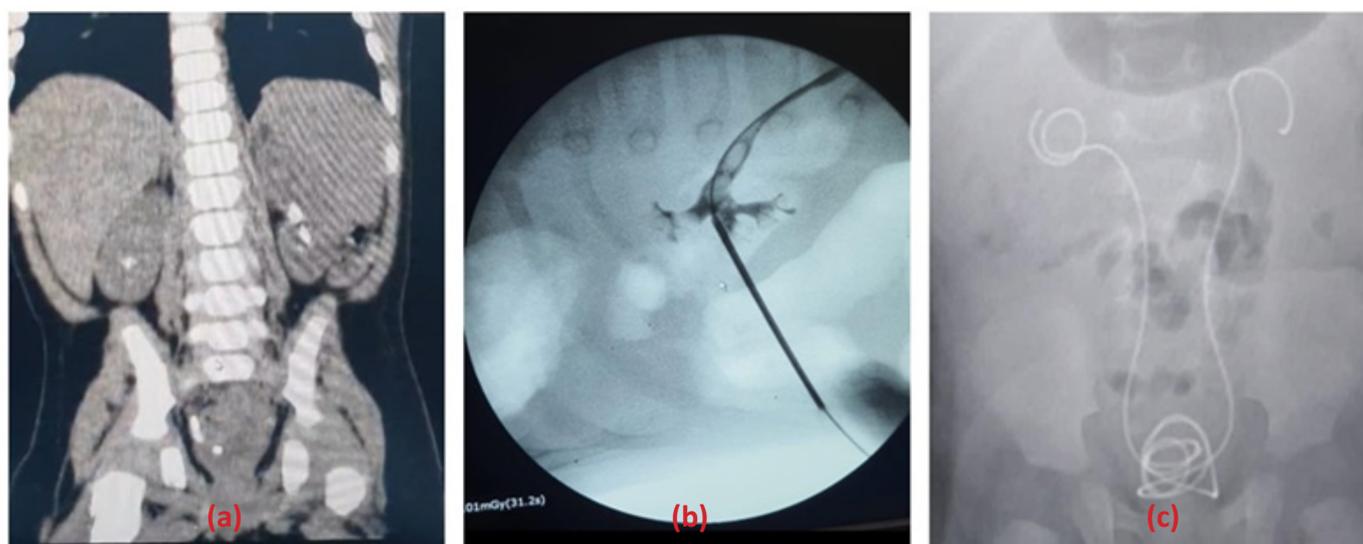


Figure 1: a): Pre-operative image; b): Intraoperative image; C): Post-operative image.

a single session, and obtaining material for analysis.

Infant kidneys are much more mobile than adult kidneys and are characterized by a relatively small renal collecting system, thin renal cortex and short skin-renal distance [14]. There is no separate guideline for the management of kidney stones in infants [15]. There is a very limited number of studies on infant kidney stones in the literature. The use of large instruments in the infant age group may lead to complications including bleeding, renal pelvis injury, ureteropelvic junction stenosis, loss of renal function and sepsis [16]. For all these reasons, PNL in the infant age group is a difficult procedure that requires caution. In recent years, there are reports that PNL can be used safely in the infant age group [17]. For all these reasons, we performed UmPNL procedure for renal calculi in our patient.

Conclusion

In experienced centers with a high caseload, surgical intervention for ureteral and renal calculi can be performed in a single session even in a 5-month-old infant if there is sufficient equipment. We believe that this procedure can be performed safely in a single session in experienced clinics.

Conflict of interest

None.

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