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Effectiveness of ureteroscopy among the youngest patients: One centre's experience in an endemic region in Turkey

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Summary

Background
In recent years, the incidence of urinary stone disease reportedly has been increasing. The use of shockwave lithotripsy has seen low success rates, the inefficacy of a single session, and the need for general anaesthesia in children; additionally, children are exposed to radiation. These suboptimal treatment conditions have all led to ureteroscopy (URS) becoming the treatment method of choice for paediatric ureter stones. The aim of this study is to examine the effectiveness of 4.5-Fr URS when used on children younger than 1 year of age.

Patients and methods
The operation results of 34 patients (12 girls and 22 boys) who had undergone intervention for ureter stones at our clinic were retrospectively evaluated. For URS, a 4.5-Fr semi-rigid ureteroscope was used; a Holmium:YAG laser machine was used as a lithotripter.

Result
The mean patient age was 9.6 months (range 4–12 months) (Table). The mean stone surface area was 25.39 mm^2 (range 11.84–84.78 mm^2). In six cases, a ureteral catheter was inserted, because of minimal oedema in the ureters; in nine cases, a Double J (DJ) stent was inserted. The mean operation time was 45.3 min (range 22–87 min). In the first week of control with urinary ultrasonography and kidney–ureter and bladder radiograph, a stone-free condition was determined in 28 (82.3%) patients. In two cases—in which sufficient fragmentation could not be achieved, because of minimal bleeding during operation—during the exertion of a DJ stent, another URS was performed. In the first postoperative month, a stone-free condition was established in 32 (94.1%) patients. The mean hospital stay period was 28.6 h (range 12–72 h). There were seven cases (20.5%) with Clavien II–III complications.

Conclusion
Use of a ureteroscope is safe and effective with paediatric patients: we found that a 4.5-Fr ureteroscope can be safely used on children under 1 year of age. We therefore consider a 4.5-Fr ureteroscopic instrument to be an appropriate tool for treating URS in children within this age range.

Table The data work.

Age	9.6 months (4–12)
Stone surface area (mm^2)	25.39 (11.84–84.78)
Operation time	45.3 min (22–87)
Stoneless	
First week	28 patients (82.3%)
First month	32 patients (94.1%)
Total complications	7 patients (20,5%)

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Introduction

Stone disease in the urinary system is an important health problem in the paediatric age group, in both underdeveloped and developing countries [1]. In recent years, the incidence of urinary stone disease has reportedly been increasing [2]. Paediatric urolithiasis in children differs from that in adults, in terms of aetiology, incidence, and disease course [3]. In paediatric patients, renal stones are usually caused by an underlying disease or disorder, such as anatomical and metabolic abnormalities or recurrent urinary system infections [4]. For this reason, it is very important to defer to minimally invasive interventions for paediatric-age patients, given the probability of recurrence at a later age.

With the development of instrumentation and technology, endoscopic methods have become safer and more effective [5]. Accordingly, the treatment of ureter stones has improved greatly since the 1990s. The main technical improvements include the miniaturization of endoscopes, developments in imaging techniques, and reductions in the sizes of working elements [6].

Shockwave lithotripsy (SWL) also can be used to treat ureteral calculi; however, this is a more specific issue and debate. Because there may also be technical problems that arise with localization and focusing of ureteric stones in children, success rates with SWL are lower for distal ureteric stones [7]. Low success rates, the need for recurrent sessions, the need for the use of recurrent general anaesthesia in children, and the radiation exposure that comes with SWL has made ureteroscopy (URS) the method of choice in treating paediatric ureter stones [8].

Urologists gaining sufficient experience with semi-rigid ureteroscopes in undertaking interventions on adult patients has led paediatric ureteroscopy to become more popular. URS is a surgical procedure that can be performed more easily in adult and adolescent patients than in those of preschool age—younger children are more prone to complications because of the small diameter and fragile structure of the ureter [9]. For this reason, the use of semi-rigid ureteroscopes with thinner calibres in paediatric cases has been advised by some studies [10]. To minimize complications in such cases, a 4.5-Fr semi-rigid ureteroscope has been developed.

Only a few studies in the literature address the ureteroscopy experience with infant patients [8]. Ureteroscopy requires high levels of attention, experience, and endo-urological speciality on the part of the surgeon, especially with patients younger than 1 year of age. In the current study, we aim to report retrospectively the results of treating children younger than 1 year of age with a 4.5-Fr semi-rigid ureteroscopy for ureter stones.

Patients and methods

Our study protocols were approved by the Dicle University Medical School ethics committee. Following approval, we retrospectively evaluated the operation results of 34 patients (12 girls and 22 boys) with a mean age of 9.6 months (range 4—12 months) who had undergone operations for ureter stones and undergone URS between January 2011 and June 2015 in our clinic. The demographic data of the patients are summarized in Table 1.

For stone localization, kidney—ureter and bladder radiograph (KUB), urinary ultrasonography (US), intravenous pyelography, and/or noncontrasted computed tomography (CT) were used. As per the literature, the stone surface area was evaluated using the formula of length $\times$ width $\times$ 3.14 $\times$ 0.25 [7]. In each case, a routine urological examination was performed before the operation, and both a metabolic risk adjustment and biochemical evaluation were performed on children with stone disease. Urinary infections and coagulopathies were excluded from our retrospective evaluation. In cases of paediatric ureteral stones $<$3 mm, stones are likely to pass spontaneously; however, stones $>$4 mm in the distal ureter probably require endourological intervention [11]. Therefore, all the patients in our study had had at least one ureter stone larger than 4 mm in size. Immediate surgery was not considered for patients with ureteral stones. After the 2-week follow-up, patients with ureteric stones were again treated.

Instrument: 4.5-Fr semi-rigid ureteroscope

A 4.5-Fr semi-rigid ureteroscope (Ultra-Thin Uretero-Renoscope 4.5/6.5 Fr; Richard Wolf GmBH, Knittlingen, Germany) was used to perform URS. The outer diameter of this instrument was 4.5 Fr at its most distal parts, and its width increased subsequently to 6.5 Fr at the most proximal ends. Forceps or stents with a 3.3-Fr diameter at the widest point could be passed through it.

The same surgeon performed all operations, using a Holmium:YAG laser machine lithotripsy device (StoneLight; Minnetonka, MN, USA). Stone fragmentation was accomplished with a 150-μm Ho:YAG laser fibre, using the dusting technique at a setting of 6 Hz and power of 0.6 J. As all stones were fragmented to 1 mm, stone analysis could not be performed. Smaller stone parts were allowed to spontaneously drop down. All patients received prophylactic 50-mg/kg parenteral first-generation cephalosporin on the morning of the operation; additionally, oral antibiotics and analgesic and anti-inflammatories, if required, were prescribed on the first day. Orally administered first-generation cephalosporin was advised for 3 days in the postoperative period. Routine dilatation was not performed. If there were difficulties with ureteral engagement, a 0.035” hydrophilic guide wire (SensorTM Guide Wire; Boston Scientific, Natick, MA, USA) was inserted with the assistance of fluoroscopy. Isotonic fluids heated to body

Table 1 Demographic features of patients.

Gender M/F	22/12
Age	9.6 months (range 4—12)
Laterality right/left	20/14
Stone surface area (mm^2)	25.39 (range 11.84—84.78)
Stone localization	
Proximal	4 patients (11.7%)
Mid	9 patients (26.5%)
Distal	21 patients (61.8%)