

OUR RESULTS FOR RIGID URETEROSCOPY AND LASER LITHOTRIPSY IN PEDIATRIC AGE GROUP

Çocukluk Yaş Grubunda Rijit Üreteroskopi ve Lazer Litotripsisi Sonuçlarımız

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ABSTRACT

Objective: Urolithiasis is an important disease that can lead to permanent kidney dysfunction and severe clinical symptoms in pediatric patients. We aimed to present our findings of rigid ureteroscopy combined with Holmium YAG laser lithotripsy.

Material and Methods: We retrospectively reviewed the ultrasonography, and medical records of pediatric patients with urolithiasis who were operated in Sutcu Imam University Department of Pediatric Surgery, Kahramanmaraş between April 2018 and December 2019.

Results: Sixty-one pediatric patients (M/F=38/23) with urolithiasis were enrolled in this study. The mean age was 6.7±4.9 years (range 3 month-17 years). Thirteen (34.2%) male patients need an urgent operation (rigid ureteroscopy combined with Holmium YAG laser lithotripsy) while the corresponding number was 4 (17.4%) in female patients. The difference between two sexes was statistically non-significant (p=0.156). Thirty-two male patients (84.2%) and 12 (52.2%) females patients had a successful operation (rigid ureteroscopy combined with Holmium YAG laser lithotripsy). The difference between the two sexes was statistically significant (p=0.019). The ratio of female patients with right-sided stone was significantly greater than the corresponding rates of male patients (p<0.001). There was no difference between infants (<3 years of age) and toddlers (>3 years of age) with respect to gender, side of stone, procedural success, and need for urgent surgery (p>0.05). Regression analysis showed that female gender was a risk factor for a failed attempt (OR=-0.313, 95% CI: 0.052 – 0.528; p=0.0018).

Conclusion: Safe and effective stone treatment can be performed considering that more than one operation can be performed in infants and children with mini ureteroscopy and holmium laser. However, while evaluating this treatment option in female patients, alternative treatment methods such as flexible or percutaneous nephrolithotomy may be preferred.

Keywords: Urolithiasis, rigid ureteroscopy, Holmium YAG laser lithotripsy, children

ÖZ

Amaç: Ürolitiazis, pediatrik hastalarda kalıcı böbrek fonksiyon bozukluğuna ve ciddi klinik semptomlara yol açabilen önemli bir hastalıktır. Bu çalışmada, rijit üreteroskopi ve Holmiyum YAG lazer litotripsisi sonuçlarımızı sunmayı amaçladık.

Gereç ve Yöntemler: Nisan 2018 ile Aralık 2019 tarihleri arasında Sütçü İmam Üniversitesi, Çocuk Cerrahisi kliniğinde ürolitiazis tanısı ile opere olan çocuk hastaların ultrasonografi bulguları ve tıbbi kayıtları geriye dönük olarak değerlendirmeye alındı.

Bulgular: Bu çalışmaya ürolitiazis tanısı almış 61 çocuk hasta (E/K=38/23) alındı. Ortalama yaş 6.7±4.9 yıl (3 ay-17 yıl) idi. On üç (%34.2) erkek hastanın acil girişim (rijit üreteroskopi ve Holmiyum YAG lazer litotripsisi) ihtiyacı olurken, kız hastalarda bu sayı 4 (%17.4) idi. Bu konuda iki cinsiyet arasındaki fark istatistiksel olarak anlamlı değildi (p=0.156). Otuz iki erkek hasta (%84.2) ve 12 (%52.2) kız hastada işlem (rijit üreteroskopi ve Holmiyum YAG lazer litotripsisi) başarılı bir şekilde sonuçlandı. Erkek hastalardaki bu başarı oranı kız hastalardan istatistiksel olarak anlamlı yüksek idi (p=0.019). Sağ tarafta taşı olan kız hasta oranı, erkek hastaların oranlarından daha anlamlı olarak yüksekti (p<0.001). Küçük yaşta çocuklar (<3 yaş) ile diğer yaşta çocuklar (>3 yaş) arasında cinsiyet, taşın tarafı, işlem başarısı ve acil cerrahi gereksinimi açısından fark yoktu (p>0.05). Regresyon analizinde, kız cinsiyetinin girişimin başarısızlığı açısından risk faktörü olduğu saptandı (OR=-0.313, %95 CI: 0.052-0.528; p=0.0018).

Sonuç: Mini üreteroskopi ve holmiyum lazer, çocukluk yaş grubundaki ürolitiazis vakalarında güvenli ve etkili tedavi seçeneğidir. Ancak özellikle kız hastalarda bu tedavi seçeneği değerlendirilirken alternatif tedavi yöntemleri olan fleksibl veya perkutan nefrolitotomi tercih edilebilir.

Anahtar Kelimeler: Ürolitiazis, rijit üreteroskopi, Holmiyum YAG lazer litotripsisi, çocuk



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Received / Geliş Tarihi: 14.04.2021

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Accepted / Kabul Tarihi: 04.06.2021

INTRODUCTION

Urolithiasis is an important disease that can lead to permanent kidney dysfunction and severe clinical symptoms in pediatric patients. The lifetime probability of a human to have urolithiasis is 12% (1). In endemic countries such as Turkey urolithiasis is seen in 17% of children under 14 years of age (2). The average age of occurrence is around 7 years for girls and 5 years for boys (3). Its incidence is increasing not only in our country, but all over the world. Treatment for urolithiasis is difficult, especially in the pediatric age group. The current treatment alternatives include extracorporeal shock wave lithotripsy (ESWL), ureteroscopy (URS), percutaneous nephrolithotomy (PNL). Rigid and flexible URS are the most commonly performed procedures for urolithiasis treatment (4). Introduction of holmium:yttrium-aluminum-garnet (Ho:YAG) laser lithotripsy with URS have increased the success rates while decreasing the complications (5-7). Upper ureteral and pelvic calculi frequently cause obstructive uropathy and subsequent kidney dysfunction (5). Therefore, in these cases, URS has been combined with Ho:YAG laser lithotripsy. We aimed to present our findings of rigid URS combined with Ho:YAG laser lithotripsy in pediatric patients.

MATERIALS AND METHODS

We retrospectively reviewed the ultrasonography, and medical records of pediatric patients with urolithiasis who were operated in Sutcu Imam University Department of Pediatric Surgery, Kahramanmaraş between April 2018 and December 2019. Each patient's age, gender, and operational technique were recorded. Patients with severe symptoms and advanced hydronephrosis were urgently operated while patients with mild hydronephrosis and mild symptoms were operated on an elective basis. JJ catheter was inserted for passive dilation when the ureter could not be passed with Mini URS. During the semirigid URS procedure, a 4.5

fr tip and a 6.5 fr ureteroscope extended conically towards the rear. It has a 3.5-fr working channel (RZ Medizintechnik, Tuttingen, Germany). Stones detected by URS were broken with Holmium laser. During this procedure a green light was reflected on the stone and a pulse was produced. The Laser probe was a Fiber-optic laser probe-365 micron (Quanta System S.p.A., Milan, Italy). The stones were broken into pieces that could easily fall off without getting stuck inside the ureter (Figure 1). During the procedure, if the ureter mucosa was damaged or eroded by a stone, the procedure was terminated after placing a JJ catheter. The catheter was removed and URS was performed in the same session 1-2 weeks later. Our study only included patients treated with mini URS. The follow-up period was 6 months if a patient was stone free; if not, the follow-up period was extended beyond 6 months.

Study data were analyzed using SPSS 17 (SPSS Inc., Chicago, IL, USA) software package. For independent samples, t-test and Chi-square test were performed to compare two independent groups. The level of significance was set at $p < 0.05$. The ethics committee approval of the study was obtained from Sutcu Imam University Clinical Research Ethics Committee (Date: 29.03.2021 / Decision no:2021.12.03)

RESULTS

Sixty-one pediatric patients (M/F=38/23) with urolithiasis were enrolled in this study. The mean age was 6.7 ± 4.9 years (range 3 month-17 years). Seven (11.4%) patients were under 1 year of age, and 20 (32.7%) patients were under 3 years of age.

Re-operation was required in 13 (21.3%) patients. No postoperative complications developed in any patient. Twenty-one (34.4%) patients had a stone in the right ureter; 19 (31.1%) patients in the left ureter; 13 (21.3%) patients in the right pelvis; and 8 (13.1%) patients in the left pelvis. The ratio of female patients with right-sided stone was greater than the corresponding rates of male patients ($p < 0.001$)

Forty-four (72.1%) patients were successfully cured but sixteen patients had a residual stone in a lower calyx of the kidney. In one patient we switched to open surgery. The stone analysis could be performed in 14 patients (23%). Of these, 11 were calcium oxalate stones and 3 were ammonium urate stones.

Thirteen (34.2%) male patients needed an urgent operation while the corresponding number was 4 (17.4%) in female patients. The difference between two genders was statistically non-significant ($p=0.156$). Thirty-two male patients (84.2%) and 12 (52.2%) females patients had a successful operation. The difference between the two genders was statistically significant ($p=0.019$) (Table 1). There was a significant difference between both sexes regarding mean age or a need for multiple operations ($p=0.02$). There was no difference between infants (<3 years of age) and toddlers (>3 years of age) with respect to gender, side of stone, procedural success, and the need for urgent surgery ($p>0.05$) (Table 2).

The range of stone size was between 5 mm and 15 mm (mean 7.4 mm, median 8 mm), with a patient having a stone of 21 mm. which was also fractured under laser until it became a 3-mm residual fragment that was deemed clinically insignificant. In patients who received anesthesia for a second and a third time a JJ catheter was placed after the stone was broken. Anesthesia was administered for a total of seventy times.

Passive dilation procedure was defined as putting JJ first to patients whose stone cannot be reached, and the ureter was entered 2 weeks after it was dilated and the stone was broken. Passive dilation was used in 16 patients. Pyelonephritis or gross hematuria did not occur after surgery. Regression analysis showed that female gender was a risk factor for a failed attempt (OR=-0.313, 95% CI: 0.052 – 0.528; $p=0.0018$). Neither patient age nor stone side was a risk factor for failed surgery.

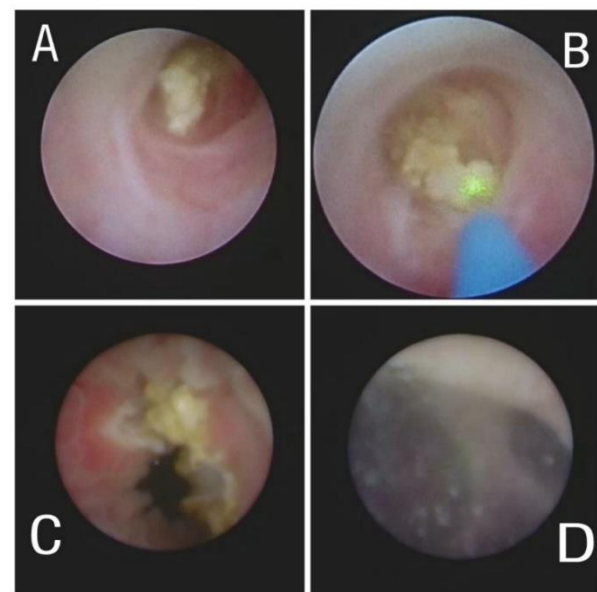


Figure 1: Visualization of the stone inside the ureter (A); its fragmentation with the holmium laser (B); after the ureter lumen is opened (C), it is tracked up to the renal pelvis (D).

Table 1: Demographic and clinical characteristics of the cases

Variable	Male (n=38)	Female (n=23)	p
Age (year)	6.74±4.6	6.74 ± 5.6	0.878
Right side (n/%)	19 (50)	15 (65.2)	<0.001
Right pelvis (n/%)	5 (13.1)	8 (34.7)	0.045
Multiple operation (n/%)	12 (31.6)	14 (60.9)	0.020
Success (n/%)	32 (84.2)	12 (52.2)	0.019
Urgent surgery (n/%)	13 (34.2)	4 (17.4)	0.156

Table 2: Comparison of age groups in mean of gender, location and clinical results

Variable	<3 year of age (n=20)	>3 years of age (n=41)	p
Male (n/%)	10 (50)	28 (68.3)	0.166
Right side (n/%)	10 (50)	24 (58.5)	0.242
Success (n/%)	12 (60)	32 (78)	0.171
Urgent surgery (n/%)	5 (25)	12 (29.3)	0.727

DISCUSSION

In Turkey, urolithiasis is an important urologic disease among children (8,9). Treatment of urolithiasis in the pediatric age group is challenging since children have a relatively narrow urinary tract. Therefore, minimally invasive procedures have become even more important in these cases. Laser lithotripsy has recently improved urolithiasis treatment outcomes in children (10). It is also effective and safe for the removal of pediatric stones. We did not detect any major complications in our series, but we experienced failed attempts in 16 patients (26.2%), which was comparable to other recent reports in children (10).

There was a male preponderance in our population similar to the previously published studies (11). This is due to the fact that stone disease has been more common among men than women. A diet rich in protein and salt make kidney stones more likely (12). Men tend to have a greater intake of both protein and salt.

In our study, female patients more commonly needed operation. Moreover, we found that the female gender was a significant risk factor for a failed operation. This resulted from a high rate of right renal pelvic stone in female patients. Most fractured stones in the right pelvis fell into the inferior calyx. Therefore, these stones may have disappeared from the sight of URS. On the other hand, most stones in males were in the ureter. Thus, the intervention with URS was more successful in males. In female patients, alternative treatment methods such as flexible URS may be preferred. Recent studies have

shown that flexible URS is a reliable endourologic option in lower pole stones and for single intrarenal calculi (13,14).

The large percentage of young children (<3 years of age) treated in our study (32.8% under 3 years of age) shows the importance of having access to material of small size and experience in minimally invasive procedures. In other words, the places where the laser hits are already dust. Stone analysis was performed in only 14 patients. One of the weak aspects of this process is the inability to obtain material because the stone is usually pulverized by laser so that no material can be retrieved and sent for analysis. Instead of acting aggressively, the stone can be reached in the second session by entering into passive dilation.

Finally, there was no difference between young and older patients regarding the procedural success and the need for an urgent operation. This may be due to the effect of this effective and safe procedure.

Considering that more than one operation can be performed in infants and children with mini URS and holmium laser, safe and effective stone treatment can be performed. However, while evaluating this treatment option in female patients, alternative treatment methods such as flexible or PNL may be preferred. Flexible or PNL may be also preferred in kidney calyces.

Conflict of Interest: The authors declare that they have no conflict of interest.

Support and Acknowledgment: There is no funding source.

Researchers' Contribution Rate Statement: AGG, AEK, ABD contributed to the analysis and drafted the manuscript. AGG, YK designed and critically revised the manuscript. All authors have read and approved the final form of the manuscript.

Ethics Committee Approval: The ethics committee approval of the study was obtained from Sutcu Imam University Clinical Research Ethics Committee; date: 29.03.2021, decision no:2021.12.03.

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