Retrospective Analysis of 90 Patients that Underwent Retrograde Intrarenal Surgery

Retrograd İntrarenal Cerrahi Uygulanan 90 Hastanın Retrospektif Analizi

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ABSTRACT

Objective: To evaluate the results of retrograde intrarenal surgery (RIRC) performed in our clinic in cases with renal stones.

Materials and Methods: The results of 90 patients that underwent RIRC between June 2016 and January 2019 were evaluated retrospectively. The demographic data and the preoperative and postoperative clinical characteristics of the patients were examined.

Results: The mean age of 90 patients that underwent RIRC (41 men/49 women) was 43.35 (21-84) years, and the mean stone size was 16.22 (10-28) mm. The operation was performed under general anesthesia in 38 patients (42.22%) and spinal anesthesia in 52 (57.78%). The mean operation duration was 61.76 (30-115) min, and the mean stone fragmentation time was 48.33 (15-95) min. In 23 patients (25.55%), a double-J stent was inserted into the ureter since the kidney could not be reached due to stenosis. In 75 patients (83.33%), a double-J stent was placed at the end of the operation. The mean hospital stay was 1.08 (1-3) days. The stone-free rate was 71.12%. Of the cases with residual stones, 21 (23.32%) underwent an additional intervention and five (5.55%) were followed up without further intervention. Complications were observed in 13 patients (14.44%) and evaluated according to the modified Clavien classification.

Conclusion: In the presence of adequate equipment and experience, RIRC is an effective and safe procedure with high success, low complication and minimal morbidity rates in the treatment of renal stones.

Key Words: renal stone, retrograde intrarenal surgery, flexible ureteroscopy

ÖZET

Amaç: Kliniğimizde böbrek taşı tedavisinde minimal invaziv tedavi olan retrograd intrarenal cerrahi (RİRC) uygulanan olguların sonuçlarını değerlendirmek.

Gereç ve Yöntemler: Haziran 2016 - Ocak 2019 tarihleri arasında kliniğimizde RİRC yapılan 90 hastanın sonuçları retrospektif olarak değerlendirildi. Hastaların demografik verileri, operasyon öncesi ve sonrası klinik özellikleri incelendi.

Bulgular: RİRC uygulanan toplam 90 hastanın (41erkek/49 kadın) ortalama yaşı 43,35 (21-84) yıl, ortalama taş boyutu 16.22 (10-28) mm idi. Operasyon hastaların 38'inde (% 42,22) genel anestezi, 52'sinde (%57,78) spinal anestezi altında uygulandı. Operasyon süresi ortalama 61.76 (30-115) dk, taş parçalanma süresi ortalama 48.33(15-95) dk idi. Hastaların 23'ünde (%25,55) darlık nedeniyle böbreğe ulaşım sağlanamadığından üretere double J stent yerleştirildi. 75 hastaya (%83,33) operasyon sonunda üretere double J stent yerleştirildi. Hastanede kalış süresi ortalama 1.08 (1-3) gün idi. Taşsızlık oranı %71,12 idi. Rezidü taşı kalan hastaların 21'ine (%23,32) ek girişim uygulandı, 5'ine (%5,55) ek girişim uygulanmadan takip edildi. Modifiye Clavien sınıflamasına göre 13 hastada (%14,44) komplikasyon izlendi.

Sonuç: RİRC işlemi yeterli donanım ve deneyim varlığında, böbrek taşlarının tedavisinde komplikasyon oranı düşük, başarı oranı yüksek minimal invaziv bir tedavi yöntemidir.

Anahtar Kelimeler: böbrek taşı, retrograd intrarenal cerrahi, fleksible üreteroskopi

Introduction

The aim of the treatment of renal stones is to provide a stone-free status with minimal morbidity. Today, open surgery is increasingly replaced by minimally invasive procedures, such as extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PNL), retrogradintrarenal surgery (RIRC), and laparoscopic stone surgery in both adult and pediatric cases.

The European Urology Guidelines recommend ESWL as the first choice for the treatment of stones smaller than 2 cm (1). In stones of this size, the success rate of ESWL is reported as 90%; however, the success rate of ESWL decreases in stones with a harder structure; e.g., cysteine and calcium oxalate monohydrate, those located in the lower renal pole, and in cases with multiple stones (2). Although PNL is considered as the first treatment option for these types of stones and those larger than 2 cm, it has higher morbidity (3).

The treatment of renal stones through the retrograde route was first defined in 1983 by Huffman et al., who described the fragmentation of a stone located in the renal pelvis using a rigid ureteroscope and ultrasonic lithotriptor (4). In the early 1990s, there was significant progress in RIRC with the introduction of the Holmium: YAG laser to intraluminal lithotripsy (5).

Although RIRC is a minimally invasive surgical procedure generally used for kidney stones smaller than 2 cm, it is currently preferred by some surgeons for patients with a greater stone load (2). However, despite its increased safety and efficacy, RIRC is not a complication-free procedure. RIRC is preferred over PNL due to less pain, shorter hospital stay, and less morbidity, and it is also considered more advantageous than ESWL due to the greater stone-free rates (6). RIRC is used as the primary treatment option in patients with musculoskeletal deformities or bleeding disorders, renal stones that do not respond to ESWL treatment, and overweight patients.

In this study, we aimed to evaluate the results of patients that underwent RIRC in our clinic due to renal stones in light of the literature.

Materials and Methods

Ninety patients that underwent RIRC due to renal stones in our clinic between June 2016 and January 2019 were retrospectively evaluated. RIRC was usually performed in cases with a renal stone of smaller than 2 cm (up to 3 cm in selected patients), those with ESWL-resistant stones, or those with renal/skeletal anomalies or bleeding disorders. The demographic data, the location and size of the stone, preoperative and postoperative stent use, operation duration and hospital stay, and complication and stone-free rates were analyzed.

Before the operation, the patients were evaluated by anamnesis, physical examination, routine blood tests, urine analysis and culture, plain films (KUB radiography), renal ultrasonography (USG), intravenous pyelography (IVP), and/or non-contrast computed tomography (CT). Preoperative stone size was determined by measuring the longest axis on radiological examination. In cases with multiple renal stones, the stone size was defined as the sum of the largest dimensions of each stone. The ASA status and comorbidities, and the presence of chronic obstructive pulmonary disease, coronary artery disease, and diabetes mellitus were recorded. The patients found to be positive according to the preoperative urine culture were treated with antibiotics in accordance with the antibiogram results, and the operation was performed when the urine cultures were sterile. The procedure was applied to the patients with sterile urine under antibiotic prophylaxis (1 g intravenous first-generation cephalosporin).

The operation was undertaken under general or spinal anesthesia using 7.95 F OLYMPUS URF-P6 and 8.5 F Karl Storz digital ureteroscopes and Flex-X^e flexible ureteroscopes. In addition, 11-13/12-14/13-15 F 8/36/48 cm Navigator HD Boston Scientific ureteral access sheaths were used. Lastly, a Dornier Medilas H30 (16 mAmps 50/60 Hz) Holmium: YAG laser was utilized. The operation duration was measured using a timer. The time taken to reach the stone and the time taken to fragment the stone were also recorded.

RIRC Technique: The patients underwent cystoscopy in the lithotomy position, and a guide wire with a hydrophilic tip was advanced to the ureter. Control ureteroscopy was performed over the guide wire using semirigid ureterorenoscopy (9.5 F Karl Storz Endoscopy) in order to exclude ureteral pathologies and the stone and to dilate the ureter. The access sheath was then advanced over the guide wire to the proximal ureter under fluoroscopy. The renal pelvis was reached by flexible ureterorenoscopy over the access sheath where possible or over the guide wire in cases where the access sheath could not be placed. The stones were fragmented using the Holmium: YAG laser. If it was not possible to reach the kidney due to stenosis, a double-J stent was placed in the ureter, and the procedure was repeated four weeks later. The stones were fragmented until they were able to pass spontaneously. At the end of the procedure, a 4.8 Fr double-J ureteral stent was placed if required.

The stone-free rates were evaluated by Doppler USG and USG at the postoperative first month. In addition, the patients with non-opaque residual stones were assessed using non-contrast CT. The operational success was defined as a stone-free status or the presence of residual fragments smaller than 3 mm. Recurrent RIRC, URS, PNL, and ESWL were used as additional therapy in patients with residual stones where indicated.

Stone localization was grouped as lower, middle, upper calyx, and pelvis. The operation duration was calculated starting with the entry into the urethral meatus using semirigid ureteroscopy and ending with the placement of the double-J stent. Postoperative hospital stay was determined as the time between the surgery and the day of discharge.

Statistical Analysis: While, the descriptive statistics for continuous variables were expressed mean

(minimum - maximum), otherwise, number of cases and percentages were used for categorical data. Data analysis was performed by using Microsoft Excel for Office 365.

Results

The mean age of 90 patients that underwent RIRC (41 men/49 women) was 43.35 (21-84) years, and the mean stone size was 16.22 (10-28) mm. The operation was performed under general anesthesia in patients 38 (42.22%) and spinal anesthesia in 52 (57.78%). The mean operation duration was 61.76 (30-115) min, and the mean stone fragmentation time was 48.33 (15-95) min. In 23 patients (25.55%), a double-J stent was inserted into the ureter since the kidney could not be reached due to stenosis. In 75 patients (83.33%), a double-J stent was placed at the end of the operation. The mean hospital stay was 1.08 (1-3) days. The stone-free rate was 71.12%. Of the cases with residual stones, 21 (23.32%) underwent an additional intervention and five (5.55%) were followed up without further intervention. Complications were observed in 13 patients (14.44%) and evaluated according to the modified Clavien classification. The clinical and demographic characteristics of the patients are presented in Tables 1 to 3.

Discussion

With the development of new-generation flexible ureterorenoscopes and effective and reliable lithotriptors, such as Holmium lasers, RIRC has become an important alternative in the treatment of renal stones. Many patients with renal stones can now be successfully treated with PNL or RIRC without the need for open surgery.

The first RIRC series was published in 1990 by Fuchs et al., who performed flexible ureterorenoscopy in 208 patients with renal stones after mechanical ureteral dilatation for one or two weeks and reported the success of a single session of RIRC as 86% (7). In another study, Preminger et al. reported an 85% stone-free rate at the end of the third month in cases that underwent RIRC for lower calyceal stones smaller than 2 cm (8).

In their study, Hatipoğlu et al. applied RIRC to patients with a mean stone size of 15.26 mm and reported a stone-free rate of 87%. The authors found that this rate increased to 91% after the second RIRC (9). Reşorlu et al. examined the factors affecting success RIRC in their study with 207 patients and reported that stone size significantly affected the success rate (10). In their study with 100 patients,

Fabrizio et al. evaluated the characteristics of the remaining stones after RIRC and noted that the percentage of patients with residual stones increased with the increasing stone load (11). Grasso et al. grouped the lower calyceal stones as <1 cm, 1-2 cm, and >2 and calculated the stone-free rates as 82%, 71% and 65%, respectively at the third month after RIRC (12). In our study, the mean stone size was 16.22 mm, and the stone-free rate was 71.12%, which increased to 74.44% after the second RIRC. We consider that the reason for our lower stone-free rate compared to the literature is due to the presence of stones larger than 2 cm.

Urethral access sheaths are widely used in recent years because they provide convenience for recurrent ureteroscopic access to the collecting system. However, they may have the potential to cause ureteral injuries depending on their size (13). Delvecchio et al. suggested that the use of urethral sheaths during RIRC reduced the operation duration and costs and caused minimal morbidity, and thus they should be applied in routine clinical practice (14). In the current study, urethral access sheaths were used in 77.78% of the patients that underwent RIRC, and the procedure was performed without a sheath in 22.22% of the cases. Since the urethral access sheath causes ureteral edema in the postoperative period, it is generally recommended to insert a double-J stent into the ureter. In our study, this stent was placed in 83.33 of the cases that underwent RIRC.

Following RIRC surgery, severe complications rarely develop. As in other endourological operations, urinary infections should be treated with appropriate antibiotics, and the operation should be performed when the urine is sterile (15). In our study, as part of the preoperative evaluation, we carried out complete urinalysis and urine culture in all patients, and the cases that were found to have positive urine cultures received an antibiotic treatment and underwent RIRC only when their urine was sterile. We also administered routine antibiotic prophylaxis in the preoperative period. Therefore, we did not observe a serious infection in any of our cases.

Although hematuria is seen frequently due to RIRC, it does not lead to any serious condition requiring transfusion. Similarly, in our study, there was no bleeding that required transfusion.

One of the most serious complications after RIRC is ureteral stenosis. Ureteral stenosis rates have been significantly reduced with the development of smaller ureterorenoscopes, and they are now reported to be 0.5% or less (16). In the current study, we did not detect any ureteral stenosis during the early follow-up.

Table 1. Preoperative clinical and demographic data of the patients

	(n = 90)	%
Age (years)	45.35 (21-84)	
Gender Male/Female	41/49	45.55/54.45
BMI (kg/m2)	25.67 (17.8-33.29)	
Laterality Right/Left	45/45	50/50
Type of anesthesia General/Spinal	38/52	42.22/57.78
Stone size (mm)	16.22 (10-28)	
Stone localization		
Lower pole	6	6.67
Mid-pole	2	2.22
Pelvis	80	88.89
Upper pole	2	2.22
Hounsfield unit values	889.74 (414-1901)	
Comorbidities	14	15.55
CAD	9	10
DM	5	5.55
Preoperative double-J stent,	23	25.55
Preoperative hydronephrosis		
0	22	24.45
1	12	13.33
2	46	51.11
3	9	10
4	1	1.11

BMI: body mass index, CAD: coronary artery disease, DM: diabetes mellitus

Table 2. Clinical data related to the operation

	(n = 90)	%
Operation duration (min)	61.76 (30-115)	
Stone fragmentation time (min)	48.33 (15-95)	
Double-J stent placement	75	83.33
Ureteral access sheath		
Yes	70	77.78
No	20	22.22
Hospital stay (days)	1.08 (1-3)	
Additional intervention	26	28.88
Follow-up	5	5.55
PNL	1	1.11
RIRC	3	3.33
ESWL	3	3.33
URS	14	15.55
Stone-free status		
No	26	28.88
Yes	64	71.12

PNL: percutaneous nephrolithotomy, RIRC: retrograde intrarenal surgery, ESWL: extracorporeal shock wave lithotripsy, URS: ureterorenoscopy

Table 3. Complications according to the modified Clavien classification

	(n = 90)	%
Total number	13	14.44
Grade I		
Fever	1	1.11
Side pain	5	5.55
Mild hematuria	4	4.44
Minimal mucosal injury	2	2.22
Grade II		
Double-J stent migration	1	1.11

In this study, according to the modified Clavien classification, complications were seen at a rate of 14.44% in patients that underwent RIRC. Of these complications, 13.33% were classified as grade 1 (fever, side pain, mild hematuria, minimal mucosal injury), and 1.11% as grade 2 (double-J stent migration).

In conclusion, in the presence of adequate equipment and experience, RIRC is an effective and safe procedure with high success, low complication and minimal morbidity rates in the treatment of renal stones.

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