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Flexible ureterorenoscopy results: Analysis of 279 cases

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ABSTRACT

Objective: In this study, the outcomes of 279 cases in whom we performed retrograde intrarenal surgery (RIRS) were evaluated retrospectively.

Material and methods: RIRS was performed on 279 cases with the aid of access sheath of guidewire between March 2011 and February 2015. All patients were operated in the standard lithotomy position. A hydrophilic guidewire was inserted with the aid of rigid ureterorenoscopy and we checked whether there were any residual ureteral stones and other pathologies. Fluoroscopy was used routinely in all cases. Stone fragments smaller than 3 mm were left off but those bigger than 3 mm were removed by grasper after stone fragmentation. Controls of the patients were assessed by plain films (KUB), urinary tract ultrasonography (US) and/or computed tomography (CT) 1 month after the operation. Success rate of the procedure was defined as the stone-free status or presence of residual fragments less than 3 mm.

Results: 152 of the patients were male and 127 were female. The median ages of the male and female patients were 47.7 (1-86) ve 45.9 (3-79) years respectively. The median stone size was 13.5 mm (8-25). Preoperatively 34 (12.1%) patients had double-J ureteral stent. 19 (6.8%) patients were operated while they were still receiving antithrombotic and antiplatelet therapy Solitary kidney was present in 24 patients while the remaining patients had kyphoscoliosis (n=3), rotation anomaly (n=6), pelvic kidney (n=2), double collecting system (n=3), and horseshoe kidney (n=6). In 264 patients access sheath was used, in 15 patients operation was performed with the help of the guidewire. Double-J stents were inserted to 14 patients because of ureteral stricture and they underwent operation after 2 weeks later. Renal stones of 219 patients among all cases were fragmented completely and the patients were discharged as stone free (SF). Our success rate (SF or presence of clinically insignificant residual [CIRF]) was 78.4%. Stone size (p=0.029), stone number (p=0.01), stone location (p=0.023) had significant influence on the stone-free rate after RIRS The mean operation and floroscopy time was 62.5 min. (40-180) and 29.8 sec (4-96), respectively. The mean hospitalization time was 26.4 hours (12-72). Double J stents were placed to 253 patients for more stone burden and ureteral edema. Any complication was not observed for all cases except perioperative developed infection for two patients.

Conclusion: With advances in laser technology and flexible ureterorenoscopy, kidney stones can be treated with lower morbidity and high success rates.

Keywords: Flexible ureterorenoscopy; kidney stone; retrograde intrarenal surgery.

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Introduction

Many intrinsic, and extrinsic factors in combination including gender, race, geographic region, climate, seasonal factors, profession, body mass index (BMI), and fluid intake play a role in the etiology of urinary system stone diseases.[1] The prevalence of stone disease has been reported as 2.8% in the USA, 1.5% in the Europe, and 14.8% in our country.[2-4]

In parallel with the technological advances in the treatment of renal stones, lower morbidity, and higher stone-free rates have been achieved. Previously, renal stones have been treated with open surgery, while currently many minimally invasive treatment modalities as electroshock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL), retrograde intrarenal surgery (RIRS), and laparoscopic surgery can be used in place of the open surgery. The choice among

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renal stone treatments depends on the size, and location of the stone, preference, and experience of the surgeon.[5-7]

In line with advances in flexible ureterorenoscopy, and laser technology, the indications of RIRS have been enlarged. Thanks to innovative, and highly qualified imaging modalities with versatile mobile capabilities, accessibility into calyceal systems has been greatly facilitated. Owing to these innovations, RIRS has become a widely used, and important alternative in the treatment of kidney stones. Relevant guidelines advice use of RIRS as an effective, and reliable alternative generally for patients with obesity, musculoskeletal deformities, hemorrhagic diathesis, failed ESWL treatments, and stones with diameters less than 2 cm.[8,9] Although PNL with an increased morbidity for compact, and solid stones larger than 2 cm in diameter has been recommended as a first-line treatment, RIRC can be used as an alternative treatment for this type of stones.[9,10]

In this study, the data of the first 279 patients who underwent RIRS in our clinic for the management of renal stones were retrospectively evaluated, and presented in the light of the literature.

Material and methods

The outcomes of 279 patients who underwent RIRC with the indication of renal stone between March 2011, and February 2015 were retrospectively analyzed. This treatment has been applied for patients with ESWL-refractory stones smaller than 2 cm in diameter, or those associated with muskuloskeletal deformities, and bleeding disorders. Demographic data, location, and size of the stone, pre-, and postoperative stent use, duration of operation, fluoroscopy and hospitalization, complications, and stone-free rates were analyzed.

Before the operation, the patients were evaluated with physical examination, routine blood tests, urinalysis, blood culture, direct urinary system graphy (KUB), renal ultrasound (US), intravenous pyelography (IVP) and/or noncontrasted computed tomography (CT). The patients whose urine cultures demonstrated bacterial growth were treated with appropriate antibiotherapy, and operated after no growth was detected on their urine culture media.

The procedure was performed on patients with sterile urine cultures under antibiotic prophylaxis (first–generation intravenous cephalosporin). Priorly all patients in the lithotomy position underwent cystoscopic examination under general anesthesia. Then under scopy, a hydrauic guidewire was advanced upward inside the ureter. Ureterorenoscopy was performed to exclude presence of any ureteral pathology, and stone, and dilate the ureter using a semirigid ureterorenoscope (a 9.5 Fr Karl Storz Ureterorensocope, Germany) advanced over this guidewire. Then under scopy, an access sheath was advanced over this guidewire up to the proximal ureter. Inside through the access sheath or if access sheath can not be inserted, then a 7.5 Fr flexible ureterorenoscope (Karl Storz Endoscopy, Tuttlingen, Germany) was advanced upward over the guidewire into the renal pelvis. When intrarenal access can not be achieved because of the UPJ stricture, a double J stent was inserted into ureter, and left there. After 2 weeks, the procedure was repeated. The stones were fragmented using holmium YAG: laser till they could pass spontaneously. Fragments larger than 3 mm were removed using basket catheter. At the termination of the procedure, a ureteral 4.8 F double-J stent was implanted in patients with solitary kidneys, and those with priorly implanted access sheath, and heavier stone burden.

Stone-free rates of all patients were evaluated at postoperative 1st months using KUB, and US. Besides, patients with non-opaque, and rest stones were asessed using non-contrasted CT. Success was determined as stone-free status or presence of residual fragments smaller than 3 mm.

For statistical evaluations SPSS 22.0 program was used. Gender, stone location, anticoagulant use, and renal anomalies were assessed using *chi*-square test, while size, and number of stones were evaluated with Student's T test, and Mann-Whitney-U test, respectively.

Results

Retrograde intrarenal surgery was performed on a total of 279 patients (male, n=152; female, n=127). Median ages of the male, and female patients were 47.7 (1-86), and 45.9 (3-79) years, respectively. While 12 patients were younger than 12 years of age. Stones were located in the right (n=141), left (n=127) and both (n=11) kidneys. Bilateral RIRC was applied for patients with bilateral calculi during the same session. The stones were located in the lower (n=86; 30.9%), middle (n=9; 3.2%) , and upper (n=27; 9.7%) poles, renal pelvis (n=98; 35.1%), and multiple calyces (n=59; 21.1%). Median stone diameter was 13.5 mm (6-25 mm). Median stone diameters were 12.5 (8-20) mm in the lower, 14.4 (9-25) mm in the middle, 14.8 (8-20) mm in the upper poles, 14.4 (10-25) mm in the renal pelvis, and 13.0 (8-25) mm in multiple calyceal stones, respectively.

Before the procedure hydronephrosis was not detected in 145 (52%) patients, while grades 1 (n=86; 31%), 2 (n=39; 14%), and 3 (n=9; 3.2%) hydronephrosis were detected in respective number of patients. Nineteen patients (6.8%) were operated while they were still receiving antithrombotic, and antiaggregant therapy. The patients had solitary kidneys (n=24), kyphoscoliosis (n=3), rotation anomalies (n=6), pelvic kidney (n=2), duplicated collecting system (n=3), and horseshoe kidney (n=6).

Preoperatively patients had (n=34; 12.1%) or had not (n=245; 87.9%) ureteral double J stents. In 15 patients, access sheath could not be advanced from distal to proximal ureter, and the procedure was proceeded without access sheath. In 14 patients where endoscope could not be advanced further because of the presence of a stricture, ureteral double J catheter was placed, and RIRC was performed 2 weeks later. None of the patients underwent balloon dilatation. At the end of the operation ureteral double J stents were implanted in 253 (90.6%) patients.

Median operative time was 62.5 (40-180) minutes. Median operative times according to the location of the stones were as follows: lower pole, 62.1 (40-180) min; middle pole, 64.4 (60-80) min; upper pole 57.0 (45-90) min; pelvis 59.9 (40-150) min, and multiple calyces, 70.0 (45-180) min. Median durations of fluoroscopy, and hospitalization were calculated as 29.8 (4-96) sec, and 26.4 (12-120) hr, respectively. In none of the patients a serious complication was observed during, and after the operation. Only 3 patients with infection were hospitalized for 5 days, and antibiotherapy with a 3. generation cephalosporin was administered. At postoperative first month controls, complete stone-free rates were achieved in 189 (67.8%) patients, while in 30 (10.7%) patients clinically insignificant residual stones measuring over 3 mm in diameter were detected. Distribution of residual stones according to stone location was as follows: lower pole, n=20; middle pole, n=3; upper pole, n=4; pelvis, n=13, and multiple calyceal stones, n=20. Within this context, in our study we achieved an average success rate of 78.4% which was determined as stone-free rate or presence of residual stone fragments smaller than 3 mm. Distribution of success rates according to location of stones was detected as follows: lower pole, 76.7%; middle pole, 66.6%; upper pole, 85.1%; pelvis, 86.7, and multiple calyces, 66.1 percent. Patients with residual stones were treated with PNL (n=15), re-RIRC (n=19), micro-PNL (n=6), and ESWL (n=7). The procedure was terminated prematurely because of heavier stone burden in 24, blurred vision secondary to development of bleeding in 17), inability to approach to the stone using flexible ureterorenoscope in 16, and technical fault in patients, respectively. Patients' demographic data, and stone characteristics are summarized in Tables 1, 2.

Discussion

In recent years treatment of renal stones changed considerably, and thanks to the development of minimally invasive methods, highest stone-free rates have been achieved with minimal morbidity. Treatment modalities have varied from open surgery to less invasive standard, mini-, and micro-PNL, ESWL, and RIRS. In line with technological advancements, flexible ureterorensocopes with small caliber, but with higher image resolution which can be bend to either side have been produced. The first flexible ureterorenoscope was used by Marshall in the year 1964 for diagnostic purposes.[11] Thanks to their higher capacity of mobility, access into the upper urinary system is made possible. With the development of holmium laser, it has become a very important alternative in the diagnosis, and treatment of renal stones. The first RIRS series was performed in the year 1990 using flexible ureterorenoscope in 208 patients with renal stones, following mechanical ureteral dilation applied for one or two weeks with resultant 87% stone-free rates.[12]

Table 1. Demographic characteristics of the patients

			Success rates, n (%)		
		Patients n (%)	Yes	No	p-value
Patients n (%)		279	219 (78.4)	60 (21.6)	0.913
Male		152 (54.4)	120 (78.9)	32 (21.1)	
Female		127 (45.6)	99 (77.9)	28 (22.1)	
Age (years)					0.691
	8-17	13 (4.6)	10 (76.9)	3 (23.1)	
	18-60	203 (72.8)	155 (76.3)	48 (23.7)	
	≥60	63 (22.6)	54 (85.7)	9 (14.3)	
Anticoagulant use					0.773
	Evet	19 (6.8)	16 (84.2)	3 (15.8)	
	Hayır	260 (93.2)	203 (78.1)	57 (21.9)	
Renal malformations					0.510
	Evet	17 (6.1)	12 (70.6)	5 (29.4)	
	Hayır	262 (93.9)	205 (78.2)	55 (21.8)	

*Statistical significance p<0.05.

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Table 2. Stone characteristics

			Success rates, n (%)		
		Patients n (%)	Yes	No	p -value
Stone diameter					0.029*
	>20 mm	10 (3.5)	6 (60)	4 (40)	
	11-20 mm	179 (64.1)	137 (76.5)	42 (23.5)	
	≤10 mm	90 (32.2)	76 (84.4)	14 (15.6)	
Stone location					0.023*
	Lower pole	87 (31.2)	67 (77)	20 (23)	
	Pelvis	97 (34.7)	84 (86.5)	13 (13.5)	
	Upper/middle pole	34 (12.2)	27 (79.4)	7 (20.6)	
	Multiple calyces	61 (21.9)	41 (67.2)	20 (32.8)	
Number of stones					0.01*
	Single	160 57.3)	136 (85)	24 (15)	
	Multiple	119 (42.7)	83 (69.7)	36 (30.3)	
	No	262 (93.9)	205 (78.2)	55 (21.8)	

*Statistical significance p<0.05.

Reşorlu et al.[13] investigated the factors effecting the success rates in their study performed on 207 patients in the year 2012, and evaluated the factors effective on success rates as age, gender, body mass index, size, location, laterality, composition, and number of stones, lower pole-infundibulopelvic angle, anticoagulant use, skeletal, and renal anomalies. They indicated that size, location, composition of the stones, renal malformations, and lower pole- infundibulopelvic angle significantly effected the success rate. In our study, we also detected that size, number, and location of the stones effected the success rates significantly, while gender, age, anticoagulant use, and renal anomaly had no impact on the success (Table 2).

Retrograde intrarenal surgery (RIRS) has become a treatment method as effective, and reliable as ESWL in the management of stones smaller than 2 cm in size with minimal morbidity.[14] With increasing stone burden the percentage of patients with residual stone fragments also increased. Grasso et al.[15] grouped lower calyceal stones according to their sizes as <1 cm, 1-2 cm, and >2 cm stones, and 3 months after RIRC, stone-free rates of 82, 71, and 65% were detected. In our study, median stone diameter, and stone-free rate were estimated as 13.5 (8-25) mm, and 78.4%, respectively. In our study we determined that stone size effects success rates significantly, and our stone-free rates for stones with diameters of <1 cm, 1-2 cm, and >2 cm were detected as 84.4, 76.5, and 60%, respectively (Table 2).

In our study we detected that patient's age, and gender did not effect the success rates significantly. In a study by Ng CF[16] performed in the year 2009, the authors detected similar URS outcomes both in elder patients, and young adults. In another study, the authors reported that age did not effect success rates of RIRS both in adults, and pediatric patients.[13]

Watterson et al.[17] applied RIRS in 25 patients with bleeding diathesis who were receiving anticoagulant, and antiaggregant therapy with 96% success rates, and reported development of retroperitoneal hematoma during the postoperative period which required blood transfusion. In these patients, the authors emphasized that anticoagulant, and antiaggregant therapy should be discontinued in patients scheduled for ESWL or PNL, and in these cases RIRS was an effective treatment alternative. In our study, RIRS was successfully performed on 19 patients with renal stones without cessation of antiaggregant or anticoagulant therapy or development of any complication. We observed that anticoagulant, and antiaggregant therapy had not any impact on success rates (Table 1).

In challenging cases with bleeding diathesis, urinary diversion, morbid obesity, horseshoe, and pelvic kidney, polycystic kidney, calyceal diverticula, lower pole stones, non-opaque, and ESWL-refractory stones, RIRS has been preferred as the first-line therapy.[18] Benoit et al.[19] retrospectively evaluated outcomes of RIRS they performed on 17 patients with horseshoe kidneys. Ural et al.[20] performed RIRS on 24 patients with renal malrotation. In both of these studies, retrograde intrarenal surgery has been indicated as a reliable, and effective method in patients with renal anomalies. In our study, RIRS was applied in complicated cases with solitary kdineys (n=24), pelvic kidneys (n=2),

horseshoe kidneys (n=6), renal malrotations (n=6), duplicated collecting systems (n=3), and kyphoscoliosis (n=3). We did not encounter any complication in these patients, and presence of renal anomalies did not effect success rates (Table 1).

Serious complications are not frequently seen following retrograde intrarenal surgery The most frequently developed complication following RIRS is infection as is seen in other endourological interventions, while the most serious one is ureteral stricture. The potential infections should be treated with appropriate antibiotics, and the procedure should be conducted after sterilization of urine.[21] In our study, since all patients received appropriate antibiotic prophylaxis, a serious infection was not encountered in our patients. Only 3 patients had high fever at postoperative first day which was relieved with appropriate antibiotherapy. In recent years with the development of ureterorenoscopes, incidence of ureteral strictures decreased considerably. In many studies, rates of ureteral strictures lower than 0.5% have been reported.[17,22] Even though our follow-up period was not long, we haven't observed any case of ureteral stricture as a postoperative complication.

Beneficial effects, and convenience of using recently popularized access sheaths have been debated.[23] Access sheaths have been used to facilitate recurrent entries into, and exits from renal collecting systems. In a study where effectiveness of these access sheaths was evaluated, its routine intraoperative use during RIRC was recommended in that it decreases costs, and duration of operations, and causes minimal morbidity.[24] In a study by Kourambas et al.[25] performed on 59 cases where effectiveness of access sheaths was evaluated, the authors recommended routine use of access sheaths with its advantages of decreased morbidity, and expenditures. The most important disadvantage of access sheaths is their potential to cause ureteral injury because of their dimensions.[8] Owing to its abovementioned advantages, we use access sheaths for nearly all of our patients. However in 15 (5.4%) patients we couldn't advance the access sheath because of the presence of a ureteral stricture, then we achieved intrarenal access with the aid of a guidewire. One of the disadvantages of access sheath is development of postoperative ureteral edema. Rapoport et al.[26] performed a study on 167 patients who had undergone ureteroscopy. Five (14%) of 14 patients who had undergone ureteroscopy without the aid of access sheath intraoperatively, and double J-stent postoperatively had consulted to the emergency service. However 7 (37%) of 19 patients in whom access sheaths were used without postoperative implantation of double J-stent applied to the emergency services (p=0.04). In consideration of this outcome, access sheath had been implicated for ureteral edema formation. In our study we implanted ureteral double J stents in 253 (90.6%) patients with solitary kidneys, and heavy stone burden with preexisting access sheaths.

Many authors emphasized RIRS as the effective, and reliable treatment method in the management of renal stones. In the literature, success rates have been indicated to range between 65, and 92 percent.[27] Success rates detected in our study (78.4%) also complied with these success rates.

Our study has some limitations including its retrospective design, shorter follow-up period, and lack of any comparison with any other renal stone treatment modality.

We think that as an outcome of our study, in line with advanced technology, and increased experience together with its minimal morbidity, and higher success rates RIRS will play a gradually evolving role in the management of renal stones. We also believe that our results should be audited in many prospective randomized studies.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Bezmialem Vakif University.

Informed consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

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