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Original Article

Is retrograde intrarenal surgery successful in the treatment of stones in kidneys with anomalies?

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Abstract

Aim: To evaluate the results of retrograde intrarenal surgery (RIRS) in stones with anomaly in the kidney.

Material and Methods: Between April 2016 and November 2018, the data of 350 patients undergoing retrograde intrarenal surgery due to kidney stones were retrospectively examined.Patients with stones in the kidney with anomalies were recorded. Demographic data, localization of the stone, size, and success and complication rates were reviewed.In the post-operative controls, stones that were 2 mm and below were accepted as stone-free.Postoperative success was evaluated as stone-free at the 1st and 3rd months.

Results: The mean age of the patients was 50.9 ± 15.8 (20-78).RIRS was performed in 29 kidneys with anomalies.Ten patients had horseshoe kidneys, 2 patients had ectopic pelvic kidneys, 13 patients had double collecting system and 4 patients had rotation anomalies.The mean stone size was 16.3 ± 6.1 (8-30) mm. The postoperative 1st and 3rd month stone-free rate was 48.2% and 51.7%, respectively.The complication developed in 4 (13.7%) patients. All of these were minor complications.Second procedure was applied to 14 of the remaining patients.

Conclusion: In the treatment of kidney stones with anomalies, RIRS is reliable with low complication rates, but the patient should be informed about the need for additional procedures due to low stone-free rates.

Keywords: Anomaly kidney; kidney stone; retrograde intrarenal surgery; stone-free

INTRODUCTION

Renal anomalies arise from differences in embryological development and are rare (1).Among these anomalies, horseshoe kidney 1/400 is frequently seen, while pelvic ectopic kidney 1/3000, duplicate ureter 7 / 1000-2 / 100 and rotation anomaly are less frequent (2, 3).In kidneys with anomalies, the risk of stone formation increases due to the deterioration of urine drainage. Treatment of these stones with endourological methods is very difficult. It is very difficult to access and reach the stones in the kidneys with anomalies during the intervention (4-6). To date there have been publications stating that treatment of stones within kidneys with anomalies it is technically difficult with percutaneous nephrolithotomy (PCNL) and shockwave lithotripsy (SWL).As a result, success in this therapy is lower than in normal kidneys (4, 7-9).

In recent years, with the development of technology, flexible ureterorenoscopy (F-URS) has been put into use. F-URS allows the entire collector system to be monitored. In recent years, the use of holmium laser device and auxiliary instruments for lithotripsy, together with low-caliber F-URSs with increased deflection capacity, has made F-URS more desirable for stones in kidneys with difficult intrarenal anatomy (10, 11).

In recent years, reports publishing the results of retrograde intrarenal surgery (RIRS) with F-URS have started to increase in the treatment of stones in kidneys with renal anomalies.However, complications and success rates vary in these studies due to the difficulty of endoscopic intervention.Our aim in this study is to examine the efficacy and reliability of F-URS in the treatment of stones in kidneys with anomalies.

MATERIAL and METHODS

Data of 350 patients who underwent F-URS and holmium laser lithotripsy due to kidney stones between April 2016 and November 2018 were retrospectively analyzed. Patients with stones in the anomaly kidney and who underwent F-URS were included in the study.The study

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was conducted according to the Declaration of Helsinki. Ankara Yıldırım Beyazıt University Editorial Review Board approved the study (13-04/22/2020). Demographic data such as age, American Society of Anesthesiologists (ASA) score, gender, body mass index (BMI) (kg / m2) were recorded with the type of congenital anomaly. We examined the X-ray, intravenous pyelography (IVP), ultrasonography (USG), computed tomography (CT), size and localization of the stone (lower, middle, upper calyxes, renal pelvis and multiple), and noted whether there is preoperative stent.Urinary culture and urine analysis, BUN, complete blood count and coagulation tests were performed in each patient in the preoperative period. Patients who had elevated in preoperative kidney function tests, under 18 years of age, and had a urinary culture infection, and ureter stenosis during the procedure were excluded from the study.All patients received preoperative intravenous antibiotic prophylaxis.Stone-free rate (SFR) was recorded for success at the 1st and 3rd months after the operation.The presence of residual stones of 2 mm and below in postoperative controls was considered stone-free.In addition, it was recorded whether additional procedures were needed after the first operation. Also, the complications developed according to clavien-dindo classification were noted.

Surgical Technique

Rigid Ureterorenoscopy (URS) was routinely performed in all patients under general anesthesia in the lithotomy position before FURS. Hydrophilic guide wire was then inserted into the ureter via rigid URS.9.5-11.5 Fr ureteral access sheath was used to decrease intrarenal pressure in all patients. All procedures were performed using a 7.5 Fr Flex-X2 (Karl Storz, Tuttlingen, Germany) fiber optic flexible ureterorenoscopy.During the process, the stones were broken using the dusting method with holmium laser. After the operation, 4.7 Fr 28 cm double J stent was placed in the ureter treated in all patients. After the operation, fluid intake was recommended to provide 2-2.5 lt diuresis to all patients.Low-dose non-contrast CT was performed in all patients to detect residual stone at the 1st and 3rd months. If stone-free status was obtained at the first postoperative month, the double J stent was removed. In the case of residual stone, after applying additional procedures for stone-free, the double J stent was removed at the latest at 3 months.

Statistical analysis

Descriptive statistics such as mean ± standard deviation, median, range and percentage were used in the analysis of the data. Statistical Package for the Social Sciences version 20.0 package program (SPSS inc., Chicago, IL, USA) was used for the statistical analysis.

RESULTS

FURS were performed in 29 patients (9 females, 20 males) due to stones in the kidney with anomaly.Ten patients had horseshoe kidneys, 2 patients had ectopic pelvic kidney, 13 patients had double collecting system and 4 patients had rotation anomaly. Average patient age, ASA score and BMI were 50.9 ± 15.8 (20-78), 1.7 ± 0.8 (1-4) and 28.4 ± 2.3 (23-34). FURS was performed on the right kidney in 18 patients and on the left kidney in 11 patients. As for stone localization, the stones of 6 patients were seen in the lower calices, 4 in the middle, 2 in the upper calices, 6 in the renal pelvis and 11 in multiple calices. There were 5 patients who had a preoperative stent. The mean stone size was 16.3 ± 6.1 (8-30) mm. Demographic and preoperative data are summarized in Table 1. The mean operation time and length of hospital stay were 64.2 minutes (35-115) and 1.3 days (1-5), respectively. The postoperative 1st and 3rd months SFR were 48.2% and 51.7%, respectively. As the second procedure, 10 of the patients with residual stones were RIRS and 4 of them were SWL. Complications developed in 4 (13.7%) patients.Two patients had pain (Grade 1) due to stent irritation developed in 2 patients and analgesics were given.One patient had fever (Grade 2) in the postoperative period and antibiotic treatment was started. In one patient with a history of anticoagulant use in the preoperative period, renal hematoma (Grade 2) was detected in CT, which was performed due to gross hematuria in the postoperative period and was followed conservatively by giving erythrocyte suspension. This patient was discharged in the following days.

Table 1. Demographic, preoperative and postoperative data of patients

Patients number (n)	29
Age	50.9±15.8 (20-78)
Sex	
Male	20
Female	9
ASA score	1.7±0.8 (1-4)
Body mass index (kg/m^2)	28.4±2.3 (23-34)
Anomaly type	
Horseshoe kidney	10
Ectopic kidney	2
Rotate kidney	4
Duplicated ureter	13
Stone status (n)	
Single	18
Multipl	11
Stone location (n)	
Lower calyceal	6
Mid calyceal	4
Upper calyceal	2
Pelvic	6
Mulipl calyceal	11
Mean stone burden (mm)	16.3±6.1 (8-30)
Preoperative stenting	5
Operation Time (min)	64.2 (35-115)
Lenght of hospital stay (day)	1.3 (1-5)
Single session stone-free rate	% 48.2
Overall stone-free rate	% 51.7
Complication	
Minor (Gr 1-2)	4
Re-procedure	
RIRS	10
SWL	4

ASA= American Society of Anesthesiologists, RIRS=Retrograde intrarenal surgery, SWL= shockwave lithotripsy, Min=Minute

Table 2. Review of present study and literature results

References	Definition of success	Patients (n)	Anomaly type	Procedure	Mean stone burden	Overall SFR (%)	SFR after single procedure (%)	Auxiliary procedures required	Complication Minor Gr1-2	Complication Major Gr 3-5
Weizer et al. (15)	Stone free	8	HSK 4 EK 4	FURS	14 (3-20)	75	75	-	0	0
Atis et al. (22)	RF≤4mm	20	HSK 20	SURS,FURS	17.8±4.5	80	70	6 SWL	5	0
Astolfi et al.(1)	RF<2mm	13	HSK 8 MR 5	SURS,FURS	12.2 (6-22)	75	NR	0	1	0
Bozkurt et al.(5)	RF≤2mm	26	EK 26	FURS	17 (10-28)	84.7	NR	NR	3	2
Oguz et al. (12)	RF≤3mm	24	MR 24	SURS,FURS	13.5 (5-30)	83.3	75	1 SWL, 1 URS	11	2
Molimard et al. (16)	RF≤3mm	17	HSK 17	FURS	16 (7-35)	88.2	53	7 URS	8	0
Ugurlu et al. (17)	Stone free	25	HSK 3 EK 14 MR 4 DU 4	FURS	194.7 mm^2 (85-393)	88	64	6 URS, 3 SWL	3	0
Bansal et al. (23)	RF≤4mm	9	HSK 9	FURS	15.4 (NR)	88.9	67.7	3 URS	4	0
Ergin et al. (20)	RF<3mm	101	HSK 36 EK 33 MR 32	SURS,FURS	16.1 (NR)	76.9	NR	8 URS	12	2
Ding et al. (24)	Not defined	16	HSK 16	SURS,FURS	29.8 (17-42)	87.5	62.5	6 URS	3	0
Legemate et al. (18)	RF≤1mm	86	HSK 43 EK 27 MR 16	SURS,FURS	84 mm^2 (4-117)	58.3	72	15 (NR)	2	3
Gokce et al. (19)	RF<3mm	23	HSK 23	FURS	17.1 (6-25)	73.9	NR	NR	4	0
Blackburn et al. (25)	RF<4mm	20	HSK 20	NR	8.4 (2-25)	84	NR	NR	NR	NR
Singh et al. (26)	RF≤2mm	25	HSK 5 EK 14 MR 5 Other 1	FURS	14.7±4.1	88	72	3 PCNL	5	1
Present study	RF≤2mm	29	HSK 10 EK 2 MR 4 DU 13	FURS	16.3±6.1 (8-30)	48.2	51.7	10 RIRS, 4 SWL	4	0

RF= residual fragments, HSK=horseshoe kidney, EK =ectopic kidney, MR=malrotation, DU=duplicated ureter, FURS=flexibl ureterorenoscopy, SURS: semirigit ureterorenoscopy, SFR=stone-free rate, URS=ureterorenoscopy, RIRS=retrograde intrarenal surgery, PCNL=percutaneous nephrolithotomy, SWL= shockwave lithotripsy, NR=not reported

DISCUSSION

Rotational anomalies of the kidney are a rare phenomenon, but horseshoe kidneys and ectopic kidneys are frequently observed. Isolated rotation anomaly is very rare in the normal localization of the kidney and its true incidence is unknown (12). Ureteral duplication is also one of the most common ureteral anomalies and if it is not known preoperatively, urolithiasis treatment may be more difficult and complications may be higher (13, 14).

To date, studies on the surgical treatment of urolithiasis in horseshoe kidney, pelvic ectopic kidney and isolated rotation anomaly have been published. Most studies are related to the results of these anomalies separately or in combinations (1,4,11,12). As far as we know, the number

of studies in the literature publishing the results of stone surgery in duplicate ureter anomaly with these anomalies is quite low. In our study, there were horseshoe kidneys in 10 patients, ectopic pelvic kidneys in 2 patients, duplicate ureters in 13 patients, and isolated rotation anomalies in 4 patients. All of these patients underwent RIRS procedure with FURS and holmium laser. In controls, we accepted 2 mm and below as stone-free. Our postoperative 1st and 3rd month SFR rates were 48.2% and 51.7% with a single procedure. Only 4 of our patients (13.7%) developed complications and all of them were minor. In the first 3 months after the first procedure, 4 patients underwent SWL and 10 patients underwent RIRS.

In literature, there are many publications about RIRS results in kidney stones with anomalies (4). First, Weizer et al. published FURS results in 8 patients (4 horseshoes, 4 ectopic kidneys) with kidney stones in an anomaly.In their study, they reported the mean stone size as 14 mm (3-20), accepted no residual stones as success, and found success rates as 75% in one procedure; none of the patients had additional procedures and reported no complications (15). Molimard et al performed RIRS operations on 17 patients with horseshoe kidneys. They accepted success as a residual stone of 3 mm and below. They reported the mean stone size as 16 mm (7-35). In the first procedure, they found SFR as 53%, applied additional procedures to 7 patients, and reported overall SFR as 88.2%, and 8 patients developed minor complications (16). İn another study, Bozkurt et al. performed RIRS in 26 patients with pelvic ectopic kidneys. They accepted the remaining 2 mm and below residual stones as a success. They reported an average stone size of 17 mm (10-28). They did not report the success rate in the first procedure and the need for additional procedures. They reported overall SFR 84.7%. They reported 3 minor and 2 major complications (5). Ugurlu et al. performed RIRS to 25 anomaly kidneys (14 ectopic, 3 horses, 4 malrotation and 4 duplicated ureteral kidneys). They accepted success as no residue stone. In the first procedure, they found SFR to be 64%, 9 additional procedures were performed and overall SFR was reported as 88%. In their study, most patients had single stones, and the proportion of their lower pole stones was reported to be around 50%. They reported minor complications in 3 patients in total (17). Legemate et al. (18) Clinical Research Office of the Endourological Society (CROES) URS Global Study screened 11,885 patients. They identified both renal and ureteral 86 anomaly kidneys (43 horseshoes, 27 ectopic and 16 malrotation kidneys). They accepted success as a residual stone of 1 mm and below and they reported overall SFR and complications as 58.3% and 2 minor, 3 major, respectively. Lavan et al. (4) published a meta-analysis including 14 studies involving 413 patients who underwent FURS in anomaly kidney stones. They reported the initial and final SFR as 76.6% and 82.3%. They reported complication rates as 17.2% and reported that most of them were minor complications. In our study, the operation time and the length of hospital stay were similar to those in the literature (5, 12,17-18, 20).

It has been reported in studies comparing FURS and other methods in kidney stones with anomalies. Gokce et al. compared FURS and SWL results in 67 patients with horseshoe kidneys. Demographic data of the patient and stone were similar between the groups. They found SFR 73.9% in the FURS group and 47.7% in the SWL group (p 0.039). They did not notice any difference between the groups in terms of complications (19). Ergin et al. In their 10-year follow-up, they reported the surgical results of 101 patients with anomaly kidney stones. They compared the results of patients with FURS and PCNL in horseshoe kidneys. They found overall SFR as 72.2% in the FURS group and 90% in the PCNL group.In the same study, they compared the results of FRUS and Laparoscopic Piyelolithotomyfor stones in the ectopic kidney. They reported SFR from the FURS group as 83.6% and 100% in the laparoscopy group. Finally, in the same study, they compared FURS and PCNL results in malrotation kidney stones. In the FURS and PCNL group, SFR was reported as 75% and 83.3%, respectively. In the same study, SFR was reported as 76.9% for FURS in all renal anomalies (20).

It is reported in the literature that the endourological treatment of stones in kidneys with anomalies is lower than the stones in normal kidneys. In our study, our 1st and 3rd month success rates are quite low compared to the literature. There may be several reasons for this.The first may be that stones in the majority of our patients are larger in size and in multiple calyxes, so it requires additional procedures by extending the duration of the operation. In addition, since the number of patients with horseshoe kidneys is high, the number of patients in which we couldn't return to the lower calyx with FURS is high, so the proportion of patients with residual stones is high. The second reason may be that the residual stone size we accept for success is 2 mm and below. Since this value is lower in other reports, it may have reduced our success rates slightly. In this regard, meta-analyzes are needed where the results of the centers, which apply the same surgical technique, similar stone size and localization, and the same residual stone size used as the definition of success, are combined. This is the only way in whichbetter objective success rates can be reported. If we look at the complication rates, our rates were found to be similar or lower to that of the literature. The literature, which contains information about the present study and other studies, is given in Table 2.

Our study has different aspects from other studies. Duplicate ureter was not included in the majority of other anomaly kidney and FURS studies. As far as we know, our study is the only study involving the highest number of duplicated ureters among the studies on FURS in kidney stones with other anomalies.Chertack et al. During the 17-year follow-up, they performed semi rigid URS to 50 duplicated ureter patients and compared them with the control group. Operation time was found to be high in the duplicate ureter group. However, it has been reported that there is no difference in success and complication rates by knowing duplication preoperatively (21). However, there are no other anomalies in their study.

CONCLUSION

The limitations of our study include retrospective, low number of patients, no comparison with other endourological methods. As a result, RIRS success rates with flexible ureterorenoscopy in kidney stones with anomalies are lower than stones in normal anatomical kidneys. However, it is very reliable in terms of complications.

Competing interests: The authors declare that they have no competing interest.

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Ethical approval: Ankara Yildirim Beyazit University Editorial Review Board approved the study (13-04/22/2020).

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