Is RIRS Safe and Efficient In Patients With Kidney Stones Who Had Previous Open, Endoscopic, or Percutaneous Kidney Stone Surgery? One Center Retrospective Study

Burhan Baylan[1], Sercan Sarı[2]*, Mehmet Caglar Cakıcı[3], Volkan Selmi[2], Harun Özdemir[4], Hakkı Ugur Ozok[5], Ahmet Nihat Karakoyunlu[1], Hikmet Topaloglu[1], Azmi Levent Sagnak[1],Hamit Ersoy[1]

Purpose: In our study, we assessed the efficiency and reliability of retrograde intrarenal surgery secondary to open surgery for kidney stone treatment. Moreover, we compared the efficiency and safety of retrograde intrarenal surgery for the patients with previous history of open surgery, percutaneous nephrolithotomy, secondary retrograde intrarenal surgery (RIRS) and primary RIRS.

Materials and Methods: Data was retrospectively reviewed. Patients who had kidney anomalies, who had been stented due to ureteral stricture in the operation and who were < 18 years old, were excluded. There were 30 patients who underwent RIRS secondary to open surgery. The demographic and stone characteristic as well as intraoperative and postoperative data of the patients were recorded. 30 patients with similar demographic and stone characteristics to those patients were selected by match pairing method from patients who had previous PNL, RIRS history and had undergone primary RIRS. A total of 120 patients, in total 4 groups, were included in the study.

Results: Statistically significant difference was detected among the groups with regards to shock wave lithotripsy history and preoperative JJ stent rate. There was no statistically significant difference in terms of stone characteristics, intraoperative and postoperative data.

Conclusion: RIRS is an efficient and safe method for kidney stone treatment of the patients with previous history of open surgery, percutaneous nephrolithotomy and retrograde intrarenal surgery. It has a similar efficiency and safety for the patients who have undergone retrograde intrarenal surgery. This is the first study that compares the patients especially with different previous surgery methods.

Keywords: efficiency; kidney stone; previous surgery; retrograde intrarenal surgery; safety

INTRODUCTION

Urinary stone disease is a significant health problem affecting human health. Kidney stone prevalence is 1-5% in general[1]. Shock Wave Lithotripsy (SWL), percutaneous nephrolithotomy (PNL), open surgery and recently retrograde intra-renal surgery (RIRS) are used for the treatment of kidney stones. By recently developing technology, certain improvements have been ensured for kidney stone treatment. Non-invasive methods have replaced the invasive ones. Despite significant decrease in preference for open surgery, it is still preferred for selected cases[2,3]. Usage of RIRS has increased thanks to developing technology and increasing experience in recent times. Efficiency of RIRS for kidney stone treatment has been indicated in the studies[4]. Kidney stone may require repetitive surgical intervention subsequent to surgical treatment. Fibrosis arising after open surgery and changing anatomy may decrease success[5]. There are studies regarding percutaneous nephrolithotomy after open surgery procedures for kidney stone treatment[6-8]. Although percutaneous nephrolithotomy is an efficient treatment method, life-threatening complications may be observed[9]. There are a limited number of studies regarding usage of RIRS following open surgery[10,11].

There are studies regarding the factors affecting RIRS success[12]. Its usage widened with the advanced technology[13]. We planned the first study especially evaluating the effect of previous stone surgery on RIRS safety and efficacy.

In our study, we aimed to assess the efficiency and reliability of RIRS secondary to open surgery for kidney stone treatment. Moreover, we planned to compar the efficacy of RIRS after previous open surgery, previous PNL and RIRS and primary patients.

MATERIALS AND METHODS

The data of the patients who had underwent RIRS in our

[1]Department of Urology, University of Health Sciences, Diskapi Yildirim Beyazit Training and Reserch Hospital , Ankara,Turkey.
[2]Department of Urology, Bozok University Faculty of Medicine,Yozgat,Turkey
[3]Department of Urology, Medeniyet University, Göztepe Training and Research Hospital, Istanbul,Turkey.
[4]Department of Urology, Avcılar State Hospital, Istanbul,Turkey.
[5]Department of Urology, Karabük University, Faculty of Medicine,Karabük,Turkey.
*Correspondence: Bozok University, Department of Urology,Yozgat, Turkey.
Phone: +90 5356608838 Fax: + 90 354 2127060. E-mail: sercansari92@hotmail.com.
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Table 1. Demographics and stone characteristics of the studies patients

	Group Previous Open Surgery	Group Previous PNL	Group Previous RIRS	Group Primary	*p*
Age(years)(±SD)	52.16 ± 12.31	49.9 ± 9.84	51.57 ± 11.29	50.5 ± 8.99	.843
Gender(M/F)(n)	19/11	20/10	19/11	18/12	.962
BMI(kg/m2)(±SD)	29.2 ± 4.6	26.62 ± 3.77	29.76 ± 4.98	27.23 ± 2.54	.056
SWL History (n, %)	9(30)	12 (40)	4 (13.32)	15(50)	< .001
Anticoagulant Usage (n,%)	0	1 (3.33)	0	0	.412
Preoperative JJ Stent (n,%)	2(6.66)	7 (23.33)	18 (60)	0	< .001
Stone Laterality(R/L)(n)	14/16	15/13	15/13	11/18	.652
Stone Number(n)(±SD)	1.93 ± 0.26	1.96 ± 0.21	1.87 ± 0.15	1.80 ± 0.13	.887
Stone Size(mm) (±SD)	19.1 ± 11.94	19.2 ± 9.15	18.97 ± 5.81	19.67 ± 7.99	.579
Stone Localization (n,%)					.917
Upper Calyx (n,%)	0	0	1 (3.33)	1 (3.33)	
Lower Calyx (n,%)	12 (40)	11 (36.67)	12 (40)	12 (40)	
Mid Calyx (n,%)	3 (9.99)	1 (3.33)	3 (9.99)	3 (9.99)	
Pelvis (n,%)	7 (23.33)	4 (13.32)	7 (23.33)	7 (23.33)	
Multicaliceal (n,%)	6 (20)	10 (33.33)	5 (16.65)	5 (16.65)	
Proximal Ureter(n,%)	2 (6.66)	4 (13.32)	2 (6.66)	2 (6.66)	

SD:Standart Deviation, M:Male, F:Female, BMI:Body Mass Index, SWL:Shock Wave Lithotripsy
Mm:Milimeter, R:Right, L: Left , PNL: Percutaneous Nephrolithotomy, RIRS: Retrograde Intrarenal Surgery

clinic between 2012-2018 was reviewed retrospectively. To determine the effect of previous surgery history on RIRS safety and efficacy, the records of the patients who had underwent RIRS secondary to open surgery were evaluated. Patients who had kidney anomalies, who had been stented due to ureteral stricture in the operation and who were < 18 years old, were excluded. There were 30 patients who had underwent RIRS secondary to open surgery. The demographic and stone characteristics as well as intraoperative and postoperative data of the patients were recorded. 30 patients with similar demographic and stone characteristics to those patients were selected by match pairing from patients who had previous PNL, RIRS history and had underwent primary RIRS. The previous open surgery group was divided into groups according to stone size 5-10 mm, 11-15 mm, 16-20 mm, 21-25 mm, 26-30 mm, 31-35 mm, 36-40 mm, 41-45 mm, 46-50mm, 51-55 mm. The same number of procedures were selected randomly from the other groups. The randomization was made similarly for the criterias such as stone laterality, stone number and stone localization. Total 120 patients, in total 4 groups, were included in the study. All patients gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki.

Preoperative routine blood biochemistry tests , complete blood count, coagulation profile and hepatic markers of the patients were analysed. Preoperative urinary cultures of all patients were sterile. Kidney Ureter Bladder Graphy(KUBG) , urinary system ultrasonography (US) and unenhanced computerized tomography (CT) were performed preoperatively. The longest stone diameter in imaging was defined as the stone size. In case of multiple stones, total of the longest diameters of each stone was defined as the stone size.

All operations were performed under general anesthesia. Preoperative single dose prophylactic antibiotic treatment was applied for the patients. The ureter was penetrated by placing a hydrophilic glidewire of 0.035/0.038 inch under fluoroscopy guidance by using semi-rigid ureteroscope at modified dorsal lithotomy position. Ureteral access sheath(UAS) (9.5/11.5 F or 11/13 F) (Elite Flex, Ankara, Turkey) was placed into the ureter down to the ureteropelvic junction via guidewire under fluoroscopy guidance. Then, flexible ureteroscope (Flex-X2, Karl Storz, Tuttlingen, Germany) was moved through the UAS. In case UAS could not be placed, flexible ureteroscope was moved via hydrophilic guidewire and thus access to kidney was ensured. After finding the stone, lithotripsy was applied with 200µm holmium laser (Ho YAG Laser; Dornier Med-Tech; Munich, Germany / Dornier Med-Tech GmbH, Medilas H20 and HSolvo, Wessling, Germany) thanks to a flexible ureteroscope. The methods of dusting and fragmentation were utilized. All calyxes were controlled at the end of the operation. Subsequent to this operation, a JJ stent was placed according to intraoperative conditions. The procedure was completed by placing a 16f foley catheter. In the postoperative first day, the urethral catheter was removed. Following 3 weeks, JJ stent was taken out under daily anaesthesia. Time between starting to endoscopy and JJ stent placing was defined as operation time.

Postoperative control was evaluated by KUBG and US performed on the first postoperative day and unenhanced computerized tomography (CT) performed in the third postoperative month. The patients were followed-up for 3 months. After the controls carried out, patients who were stone free and who had residues <3 mm were accepted as successful. The intraoperative and postoperative data was recorded. The complications were recorded as per Clavien Dindo classification. The groups were compared in terms of efficiency and safety.

Statistical Analysis

Analyse of data was performed with SPSS for Windows 16.0 package program(SPSS,Chicago). One Sample Kolmogorov Smirnov test was performed to determine whether the distributions of the variables that have numerical values were normal. The distributions of the variables were not normal ($p < .05$) except age and body mass index (BMI). The comparisons between the groups were performed with One Way Anova test for the parameters with normal distribution. For the variables with non normal distribution such as stone number, stone size,operation time,scopy time and hospitalisation time, analyse between the groups were performed with Kruskal Wallis test. The analyse of the nominal var-

Table 2. Intraoperative and Postoperative Data of The Groups

	Group Previous Open Surgery	Group Previous PNL	Group Previous RIRS	Group Primary	*p*
Average Operation Time(min.) (±SD)	47.33 ± 19.33	56.67 ± 28.81	61.67 ± 27	52.53 ± 14.84	.157
Average Scopy Time (Sc.) (±SD)	26.17 ± 18.08	56.40 ± 18.25	32.2 ± 26.73	39.4 ± 29.19	.170
Postoperative JJ stent, n (%)	28 (93.33)	28(93.33)	30(100)	25(83.33)	.106
Ureteral Access Sheath Usage , n (%)	26 (86.67)	24(80)	27(90)	29(96.67)	.240
Average Hospitalisation Time(±SD) (day)	1	1	2,55 ± 1.47	1	.392
Success , (n) (%)	23 (76.67)	19(63.33)	19(63.33)	24(80)	.341
Stone-free , (n) (%)	23 (76.67)	18(60)	18(60)	21(70)	
Residuel fragment (<3mm) , (n) (%)	0	1(3.33)	1(3.33)	3(10)	
Residuel fragment (≥3mm), (n) (%)	7(23.33)	11(36.67)	11(36.67)	6(20)	
Complication rate , n (%)	1(3.33)	7(23.33)	3(10)	4(13.32)	.126
Intraoperative Complication, (n) (%)	1(3.33)	2(6.66)	1(3.33)	3(10)	
Mucosal Injury, n (%)	1(3.33)	1(3.33)	1(3.33)	3(10)	
Bleeding , n (%)	0	1(3.33)	0	0	
Postoperative Complication , n (%)	0	7(23.33)	2(6.66)	1(3.33)	
Fever (Clavien I) , n (%)	0	7(23.33)	0	0	
Bleeding (Clavien I) , n (%)	0	4(13.32)	0	0	
Urinary Tract Infection (Clavien II) , n (%)	0	0	1(3.33)		
Perirenal Hematom(Clavien 3a), n(%)	0	1(3.33)	0	0	
Steinstrasse(Clavien IIIb), n (%)	0	2(6.66)	2(6.66)	0	

Abbreviations: Min:Minute, Sc: Second, SD:Standart Deviation, MM:Milimeter, , PNL: Percutaneous Nephrolithotomy, RIRS: Retrograde Intrarenal Surger

iables such as gender, stone laterality, stone localization, UAS usage, postoperative JJ stent, success, SWL history, preoperative JJ stent, anticoagulant usage and complications was performed with pearson chi square test. $P < .05$ value was accepted as statistically significant for the results.

RESULTS

Total 120 patients were included in our study. Those who had underwent open surgery, PNL, RIRS and primary treatment were divided into Group 1, Group 2, Group 3 and Group 4 respectively.

In terms of demographic data, no statistically significant difference was found out among the groups with regards to the age, sex, BMI and anticoagulant usage. Statistically significant difference was detected among the groups with regards to SWL history and preoperative JJ stent rate. ($P < .001$) (**Table 1**)

In terms of stone data, no statistically significant difference was revealed among the groups with reference to stone laterality, number, size and localization. (**Table 1**)

In terms of intraoperative data, no statistically significant difference was observed among the groups with regards to average operation and scopy time, use of JJ stent postoperatively and UAS. (**Table 2**)

In terms of postoperative data, no statistically significant difference was established among the groups with reference to success, hospitalization and complications (**Table 2**)

DISCUSSION

Significant changes have occurred in surgical treatment of kidney stone diseases[14]. Open surgery has been displaced to the methods such as RIRS and PNL. Stone disease is a morbidity that may show recurrence. It was found out via literature review that previous kidney stone surgery did not affect success of RIRS[15]. There are a limited number of studies regarding success of RIRS after open surgery in the literature. In our study, we aimed to assess the efficiency and safety of RIRS after open surgery that was performed for kidney stone treatment. Moreover, we aimed to compare similar patients who had previous PNL and RIRS histories and those for whom RIRS was applied firstly. This is the first such study in the literature.

In the literature, there are 2 studies which assess RIRS success after open surgery performed for kidney stone treatment. In one of these studies, 53 patients who had underwent RIRS and had an open surgery history for kidney stone were evaluated. In the other study, 38 primary patients with the same characteristics were compared to 32 patients who had underwent RIRS and had an open surgery history for kidney stone. The average operation times were reported to be 79.5 ± 37.8 minutes and 82 minutes[10,11], respectively. In our study, the average operation time was 47.33 ± 19.33 minutes.

In our study, average stone number and stone size of the patients who had underwent open surgery were 1.93 ± 0.26 and 19.1 ± 11.94 mm, respectively. While average stone number was respectively 3 and 2.7±1.5 in the studies in the literature, average stone size was 14.3mm and 25.4 ± 14.7mm , respectively.

While the rate of UAS usage was 86.67% in the group that underwent open surgery, the rate of postoperative JJ stent usage was 93.33%. On the other hand, the rate of UAS usage was 77% and 95% and the rate of postoperative JJ stent usage was 100% and 71% respectively in the reviewed studies[10,11]. In terms of success rate, it was 76.67% for the group that had underwent open surgery in our study. In the other studies, it was reported as 79.2% and 82%. Complications were observed in 20.7% and 17% of the patients in the aforementioned studies in the literature[10,11]. In our study, complication was observed in 1 patient in the group that underwent open surgery.

In our study, the patients who had previous open surgery, PNL and RIRS were compared to those who had underwent RIRS firstly. The demographic and stone characteristics of the patients were similar. No statistically significant difference was observed between suc-

cess and complication rates of the patients. The developments in laser and flexible renoscopes and increasing experience may explain these findings. Similar results were revealed in the studies researching RIRS success and complications, too[16-17]. Our study is the first one in the literature that compares the patients with similar demographic and kidney stone characteristics who had previous different surgical methods and had underwent RIRS first time.

The limiting factors of our study are its retrospective design and limited number of patients. We need studies designed with larger number of patients and in a prospective design.

CONCLUSIONS

RIRS is an efficient and safe method for kidney stone treatment of the patients with previous history of open surgery, PNL and RIRS. It has a similar efficiency and safety for the patients who had underwent RIRS firstly.

CONFLICT OF INTEREST

There is no conflict of declared by the authors.

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