The Prevalence of Urinary Tract Infection Following Flexible Ureterenoscopy and the Associated Risk Factors

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Purpose: To evaluate the risk factors for urinary tract infection (UTI) after retrograde intrarenal surgery (RIRS).

Materials and Methods: A retrospective evaluation of the records of patients who underwent RIRS from January 2013 to September 2016 was performed. All interventions were done by the same surgeon and by applying the same technique.

Result: 111 patients were included in the study with a mean age of 47.5 years (range: 14-84 years). Postoperative infection rate was 12.6% (n= 14). SWL, preoperative double J stent insertion, localization, gender, and the operation side had no impact on origination of infectious complications ($P > .05$ for all). Preoperative infection history ($P = .002$, OR=7.96, %95CI: 2.0- 30.5), comorbidity score ($P = .008$, OR=7.79, CI%95: 1.7- 35.5), and residual fragments ($P = .045$, OR=5.12, CI%95: 1.03 – 25.36) were found to be the significant risk parameters of postoperative infectious complications.

Conclusion: To reduce UTI complications, it is necessary to pay attention to patients with comorbidities, prescribe appropriate prophylactic antibiotic therapy for those who have urinary tract infection history and help patients to achieve stone free status.

Keywords: infection; intrarenal surgery; kidney stone; retrograde intrarenal surgery

INTRODUCTION

Treatment of urinary tract stones changed from open surgery to endourological procedures in the last decade according to the strategy 'to achieve maximum stone extraction with minimal morbidity'. Minimal invasive procedural choices for ureteral stones were ureteroscopy (URS) and shock-wave lithotripsy (SWL) and for kidney stones; percutaneous nephrolithotomy (PNL), retrograde intrarenal surgery (RIRS) and SWL. With the increase in technological developments, RIRS has been accepted as an effective treatment option for stones smaller than 20mm and selected cases.[1] RIRS has potential advantages; lower morbidity than percutaneous procedures and higher stone free rates than SWL.[2] The RIRS procedure is a safe treatment option for renal stones of ≤ 2cm with less pain and higher success rate at first session compared to SWL.[3]

However urinary tract infections and urosepsis are the main morbidity and mortality causes after RIRS and PCNL. Antibiotic prophylaxis is strongly recommended in clinical practice.[4] UTI is one of the most common morbidities of PCNL, occurring in 21–39.8% of patients.[5] This wide and high percent of infectious complications occurs despite antibiotic prophylaxis. Infectious com¬plication rates including fever and sepsis in patients undergoing RIRS have been reported to vary from 2% to 28% and from 3% to %5, respectively.[6] Although there have been attemps to reduce UTI after RIRS in literature, still controversial issues exist and to lower the infection rates, determination of risk factors could be an important issue as much as preoperative negative urine culture. Predicting the risk factor may change treatment policy. In this retrospective study our purpose was to evaluate the risk factors for infectious complications after RIRS.

MATERIALS and METHODS

Study Population

Patients who underwent RIRS for kidney stones from January 2013 to September 2016 in our clinic were retrospectively reviewed. Demographic, pre and postoperative data were included in the study. Patients' data were reviewed in terms of age, sex, stone localization, stone diameter, stone-free status, preoperative infection history and post-operative residual stone. Charlson comorbidity index was used to standardize the comorbidities. Patients were grouped whether UTI occurred or did not occur. The stones were evaluated with computerized tomography and the longest two axis of the stone measured (mm^2) was recorded as the stone surface area. For multiple stones, total diameter was recorded. In all cases with obstruction due to uretropelvic junction or

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Table 1. Demographic data of patients (n= 111)

		Postoperative Infection		*p*
		Negative	Positive	
Gender	Male	57 (% 58.8)	8 (% 57.1)	.908*
	Female	40 (% 41.2)	6 (% 42.9)	
Symptom	Pain	71 (% 73.2)	7 (% 50.0)	.301**
	Hematuria	5 (% 5.2)	1 (% 7.1)	
	Infection	1 (% 1.0)	1 (% 7.1)	
	Incidenatal	17 (% 17.5)	4 (% 28.6)	
	AKD	2 (% 2.1)	1 (% 7.1)	
	CKD	1 (% 1.0)	0 (% 0.0)	
Opacity Opaque		85 (% 87.6)	13 (% 92.9)	1.000**
	Semi-opaque	3 (% 3.1)	0 (% 0.0)	
	Non-opaque	9 (% 9.3)	1 (% 7.1)	
Side	Right	43 (% 44.3)	7 (% 50.0)	.812**
	Left	31 (% 32.0)	5 (% 35.7)	
	Bilateral	23 (% 23.7)	2 (% 14.3)	
UTI history	Negative	86 (% 88.7)	7 (% 50.0)	.002***
	Positive	11 (% 11.3)	7 (% 50.0)	
Swl	Negative	56 (% 57.7)	8 (% 57.1)	.967*
	Positive	41 (% 42.3)	6 (% 42.9)	
Location	Upper Calyx	11 (% 11.3)	2 (% 14.3)	.137**
	Mid Calyx	10 (% 10.3)	1 (% 7.1)	
	Lower Calyx	23 (% 23.7)	3 (% 21.4)	
	Pelvis	27 (% 27.8)	6 (% 42.9)	
	UP	13 (% 13.4)	0 (% 0.0)	
	Proximalureter	13 (% 13.4)	1 (% 7.1)	
	Mid Ureter	0 (% 0.0)	1 (% 7.1)	
Peop DJS	Negative	53 (% 54.6)	5 (% 35.7)	.299****
	Positive	44 (% 45.4)	9 (% 64.3)	
Residu	Negative	87 (% 89.7)	10 (% 71.4)	.076***
	Positive	10 (% 10.3)	4 (% 28.6)	
Comorbidity	<= 3	86 (% 88.7)	9 (%64.3)	.030***
	>= 4	11 (%11.3)	5 (%35.7)	
		Mean ± SD. Median (Q1 – Q3) Postoperative Infection		*p*
		Negative	Positive	
Stone surface area		142.73 ± 109.23	224.28 ± 272.50	
		100.00 (90.00 – 160.00)	150.00 (92.50 – 237.50)	.363*****

*Pearson Chi-square test,** Pearson Exact Chi-square test, *** Fisher's Exact Chi-square test, **** Yates Chi-square test

upper urinary tract stone, a double J stent was inserted and procedure was postponed. Stone-free status was defined as either no residue or residue smaller than 4 mm in postoperative evaluation. Preoperative sterile urine was 'a must' before procedure.

Inclusion and exclusion criteria

Inclusion criteria was presence of renal stones ≤ 2 cm in diameter and patients with 2-3cm stones who preferred RIRS. The exclusion criteria was immune compromised patients, kidney anomalies, history of previous renal surgery or SWL, uncontrolled coagulopathies, pregnancy and renal failure (serum creati¬nine ≥ 1.5mg/dL), urinary tract infection (positive urine culture) and insufficient medical records. Unsuccessful ureteral access sheath insertion was also an exclusion criteria due to the increased pressure effect on renal pelvis which may increase infection risk.

Procedures

All procedures were done by same surgeon (BB) in a standard fashion. The procedure was performed under general anesthesia. Patient was positioned from trendelenburg position to lithotomy position. Orifices were checked using a 22Fr. cystoscope. Following insertion of a hydrophilic guideline catheter, a 9.5-11.5Fr. (Plasti-med, Turkey) ureteral access sheath was inserted under fluoroscopic guidance. 7.5Fr. Flexible ureteroscope (Karl Storz,Germany) was used to access the collecting system. Different laser energy were used based on the stone characteristics during operation. A 200 µm laser probe was used. Spontaneous irrigation (about 40 cm height) was the method and irrigation pump was not used in all cases. Peroperative 400 mg ciprofloxacin intravenously was used as prophylaxis in all cases and was continued for 5 days orally.

Evaluations

Postoperative urine culture was performed in all cases with fever which was defined as >38C. According to the Clavien grading system, all infectious complications were recorded. Sepsis was defined as the criteria by sepsis definitions conference[7] All patients were discharged within 24 hours after surgery. Prolonged hospital stay was related to IC. All patients were evaluated with urine analysis, KUB graphy and ultrasound one month after operation. This retrospective study was approved by the local ethic committee (26.12.2016/02).

Statistical Analysis

All analysis was done by using IBM SPSS Statistics 21.0. Continuous and categorical variables were defined as mean ± standard deviation and percent (%), respectively. Pearson Chi-square, Pearson Exact Chi-square, Fisher's Exact Chi-square and Yates Chi-square were used for significant differences of groups. Mann-Whitney U test was used when distribution between stone size and infection for normality test failed. Binary logistic regression test was the choice to find the risk factors with stepwise method. $P < 0.05$ was defined as statisti-

Table 2. Binary logistic regression (stepwise method elimination) analysis output.

	p	Odds Ratio	95% CI	
			Lower	Upper
UTI History	.002	7.966	2.077	30.550
Comorbidity	.008	7.797	1.708	35.593
Residue	.045	5.125	1.036	25.368
Constant	<.001	0.037		

cally significant.

RESULTS

One hundred eleven patients were enrolled in the study. The mean age of patients was 47.5 (range: 14-84). Demographic data is summarized in **Table 1**. Infectious complications were reported in 14 (12.6%) patients. 8 of 14 patients had only fever (Clavien 1), 4 (.03%) patients had positive urine culture (Clavien 2), and two patients (.018%) had sepsis (Clavien 4a). Early antibiotics and antipyretics were given immediately to these patients except two patients who had sepsis. These two patients were treated in intensive care unit with vasoconstrictor agents. One of those patients had acute tubular necrosis which revealed after treatment. Mortality was not observed. SWL, preoperative double J stent insertion, localization, gender, operation side and residual fragments had no impact on origination of infectious complications ($P > .05$ for all). Operation time for patients without infection and with infection were 49.12 ± 11.63 minutes and 52.85 ± 8.7 minutes, respectively ($P = .252$). Pre-operative infection history, comorbidity score and residual fragments were found responsible for postoperative infectious complications ($P = .001$; $P = .016$; $P = .04$, respectively) (**Table 2**).

DISCUSSION

The first RIRS using a flexible ureterorenoscope was described in 1990 by Fuchs et al.[8] After advances in technology especially in laser technology and scopes, RIRS was accepted as an alternative treatment method to SWL and PNL for kidney stone management in EAU guidelines. The main advantage of RIRS is minimal morbidity compared to PNL and a higher stone free rate than SWL.[9]

Postoperative infections are the most common adverse event after RIRS. Sometimes prophylactic antibiotics are not enough to solve the problem. The rate of infectious complications in this study was 12.6%. In a study by CROES, this rate was lower than our study (2.2%). However rigid ureterorenoscopy series were also included in the CROES study which might have lowered these rates[10]. Also groups were not homogenous such that only 16% of patients underwent RIRS. Berardinelli et al. confirmed our opinion with their study. UTI rates were higher in the latter study compared to CROES (7.7 %). This rate was also lower than our study but this was a multi-center study. Operation techniques and antibiotic prophylaxis were not the same and also antibiotics were continued for five days. Similarly, UTI was 8.3% in a retrospective study by Fan et al.[11] Interestingly, systemic inflammatory response syndrome (SIRS) rate was 8.1% in another study.[12] In our study, this rate was .018 %. Early antibiotic administration and aggressive fluid therapy might explain why we had lower rates.

Preoperative infection history, comorbidity score and residual fragments were the risk factors of this study. Although residual stone alone was not a risk factor; after binary logistic regression test it became a significant risk factor. This means especially in patients with preoperative infection history, and comorbidities you should give much more effort not to leave residual stones. Similarly; comorbidities, history of recurrent UTI were the examples of risk factors according to Grabe et al.[13] In another study, Fan et al. found that operation time, infection stone and pyuria were significant parameters for UTI.[11] Stone burden, infection stone, irrigation with a high flow rate and small caliber sheaths were found to be responsible to develop SIRS after RIRS.[12] Unfortunately, we could not include stone types because of lack of data. In the aforementioned study about 20 % of stones was struvite stones. This may be the reason for increased SIRS rate compared to our study (8.1% vs .018%). In our study we tried to analyze a homogenous group of patients. Technique, sheaths and sheath calibers were all the same and standard. We tried to exclude the intrarenal pressure to find the risk factors. Increased intra-renal pressures were associated with UTI in the study above and also in literature[14]. Inversely to all these data above, Berardinelli et al. could not identify any predictors of IC. Lack of stone analysis and the retrospective design were the main limitations of this study.

CONCLUSIONS

Preoperative infection history, comorbidity score and residual fragments were found to predict postoperative UTI risk in this study. Antibiotic prophylaxis regimens can be determined according to previous microbial agent in patients with infection history. Although active stone removal is controversial in literature; trying to remove all fragments in patients with comorbidities and infection history may lower UTI risk.

CONFLICT ON INTEREST

None declared.

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