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Original Article

Factors associated with postoperative pain after retrograde intrarenal surgery for kidney stones

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ABSTRACT

Objective: We aimed to investigate factors related to early postoperative pain after retrograde intrarenal surgery (RIRS).

Material and methods: A prospective data analysis of 250 patients who underwent RIRS due to kidney stones was performed. Postoperative pain was evaluated in all patients by using visual analogue scale (VAS). Patients with severe pain (VAS score ≥7) were separated and included in Group I (n=46). While patients without pain or with insignificant pain were included in Group II (n=204). The impact of patient-related (age, gender, renal anomalies, shock wave lithotripsy history, preoperative hydronephrosis) stone-related (stone number, side, size, location and opacity) and operation-related (preoperative and postoperative ureteral J-stenting, ureteral injury, postoperative bleeding and fever, stone-free rates, size of access sheath, and sheath indwelling time) factors on early stage postoperative pain (if any) were investigated.

Results: Female gender increased the risk for pain 3.6-fold ($p<0.05$). One millimeter increase in stone diameter increased the risk for postoperative pain 1.15-fold. Prolonged sheath time was another important factor which increased the risk for pain ($p<0.05$). Patients with high residual fragments were also prone to early postoperative pain.

Conclusion: According to our results, patient-, stone-and operation-related factors associated with postoperative pain after RIRS were female gender, stone size and sheath time.

Keywords: Postoperative pain; retrograde intrarenal surgery; related factors.

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Introduction

The development of technology in endourology over the last years, like smaller sized flexible ureteroscopes and improved deflection mechanism led to the introduction of retrograde intrarenal surgery (RIRS) which has become one of the most common endourologic procedures for the treatment of renal stones, with higher success rates.[1-6]

Retrograde intrarenal surgery can be considered as a quite safe method because major complications rarely occur after the procedure.[7] However, only a limited number of studies have investigated the complications after RIRS.[3,5,6] Those publications mention some complications of their series, and a few of them focus on the procedural postoperative pain. We categorized intraoperative complications of RIRS by using modified Satava classification system for the first time[7], but we did not evaluate the postoperative pain as a complication because it is rather subjective.

The goal of this study was to investigate associated factors of postoperative pain after RIRS. Yet to the best of our knowledge, this is the first study in the literature about this topic.

Material and methods

After having obtained approval of Institutional Ethics Committee from Keçiören Training and Research Hospital, we performed a prospective analysis of 250 patients who underwent RIRS due to kidney stones between January 2013 and September 2014.

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All procedures were performed by using a 7.5 Fr (Karl Storz FLEX-X2, Tutlingen, Germany) flexible ureteroscope under general anesthesia. Holmium: YAG laser was used to obtain a spontaneous passage until the fragments got small enough. Ureteral access sheath was routinely used for the patients included in the study. Excluded from the study were The patients whose ureteral access could not be achieved during the procedure were excluded from the study.

The patients who underwent a standard RIRS procedure were included to the study. If the surgeon thought it necessary, a ureteral J-stent was inserted at the end of the operation. An x-ray and ultrasonography (USG) were used to determine initial stone clearance the first day of the surgery in all the patients. The patients were evaluated for final procedural success 1 month after surgery with X-ray/IVU and US. Computed tomography (CT) was used to avoid radiation exposure in patients with non-opaque stones or residual fragments. Residual fragments smaller than 3 mm and stone- free status were considered successful.

Postoperative pain was evaluated when the patients were in the patient room. They were all encouraged to call the nurse/doctor when they felt pain. Patients who did not point out pain were routinely evaluated at 2^{nd}, 6^{th}, 12^{th} hour after they were taken to patient room. Postoperative pain in all patients was evaluated using visual analogue scale (VAS) on the day of operation. Patients were showed a VAS which was a horizontal line, 10 cm in length. Then they were asked to mark on the line the level of pain that they felt presently. The VAS scores were described from 0 to 10 for each patient. Patients with severe pain (VAS score ≥7) in flank area and required additional analgesics were included in Group I (n=46). Patients without renal colic or with insignificant pain were included in Group II (n=204). Insignificant pain was described as "the patient did not require to call the nurse for analgesic". Patients with any other type of pain like myalgia, suprapubic disturbance or dysuria were not included in Group I.

We evaluated patient characteristics such as number, side, size, location and opacity of stones and history of shock wave lithotripsy (SWL). We also noted if the patients had any ureteral J-stent inserted preoperatively or postoperatively. Additionally both groups were evaluated as for the presence of preoperative hydronephrosis, ureteral injury, postoperative macroscopic bleeding, postoperative fever, stone-free rates, presence of renal anomalies (horse-shoe kidney, ectopic/pelvic kidney, malrotated kidney), size of access sheath, duration of surgery and the intraureteral dwell time of the sheath (sheath time).

Statistical analysis

All statistical analyses were performed using IBM Statistical Package for the Social Sciences, version 20.0. software for Windows (IBM SPSS Statistics; Armonk, NY, USA) Statistical significance was considered at $p<0.05$. As supplementary statistics, frequency (percent) for numerical values and medium±standard deviation and median(minimum and maximum) values for the variables obtained by measurement were used. Chi- square analysis was used for the countable variables. Mann-Whitney U test was used for comparing two independent groups. Logistic regression analysis was used to assess the risk of pain. In risk evaluation, OR (odds ratio) was calculated.

Results

Higher residual stone fragment rate was detected in patients with severe pain. While the initial success rates were 58% and 72.5% ($p>0.05$); the final success rates were 67.4% and 82.4% ($p<0.05$) in Groups I and II, respectively (Table 1).

Mean ages of the patients were 44.5 (17-75), and 43.6 (17-79) years in Groups I and II, respectively ($p>0.05$). Male/female ratio was about 1/2 and 1.7/1 in Groups I and II, respectively ($p<0.05$), and female gender was associated with early postoperative pain (Table 1). Logistic regression analysis also revealed that female gender was associated with increased risk of pain.

Renal anomaly was detected in 7 (15.2%) and 12 (5.9%) patients in Groups I and II, respectively. Although the risk for severe pain increased 2.6-fold in patients with renal anomaly, it was not statistically significant ($p>0.05$) (Table 1). The mean BMI value was not associated with pain, and the BMI values in Groups I and II were 27.6 (16.1-36.7) and 27.2 (17-38.8), respectively ($p>0.05$) (Table 2).

The distribution of opacity, number, side and location of the stones were statistically similar between the two groups ($p>0.05$). But, stone burden was associated with pain. The mean stone burden of the patients were 16.87 mm (5-48 mm) and 12.6 mm (5-40 mm) in Groups I and II, respectively ($p<0.05$). According to logistic regression analysis results, 1 mm increase in stone length increased the postoperative risk for colic pain after at 1.15-fold (Tables 1 and 2).

Ureteral access sheath was inserted in all patiens included in the study. While in Groups I, and II, ureteral access sheaths with 11.5 Fr external diameters were implanted in 28 (60.9%) and 127 (62.3%) patients, respectively, while for others ureteral access sheaths with 14 Fr external diameters were inserted. The size of the ureteral access sheath was not statistically associated with postoperative pain ($p>0.05$). On the other hand, the intraureteral dwell time of ureteral access sheath in ureter during operation (sheath time) was significantly higher

Table 1. Associated factors with renal colic on the day of RIRS

		Groups						Chi-Square Analysis	
		Group I		Group II		Total			
		n	%	n	%	n	%	Chi-Square	p
Gender	Female	29	27.8	75	72.1	104	100	9.6	0.002
	Male	17	11.6	129	88.3	146	100		
	All	46	18.4	204	81.6	250	100		
Side	Right	23	18.0	105	82.0	128	100	Fisher'sExact	0.871
	Left	23	18.9	99	81.1	122	100		
	All	46	18.4	204	81.6	250	100		
Stone location	Multiple	4	82.6	19	17.4	23	100	0.1	0.988
	Pelvis	25	81.5	110	18.5	135	100		
	Upper-middle pole	7	20	28	80	35	100		
	Lower pole	10	17.5	47	82.5	57	100		
	All	46	18.4	204	81.6	250	100		
History of SWL	Absent	32	20.1	127	79.9	159	100	0.5	0.471
	Present	14	15.4	77	84.6	91	100		
	All	46	18.4	204	81.6	250	100		
Preop. J-stenting	Absent	38	20.8	145	79.2	183	100	1.9	0.158
	Present	8	11.9	59	88.1	67	100		
	All	46	18.4	204	81.6	250	100		
Preop. Hydronephrosis	Absent	32	19.4	133	80.6	165	100	0.154	0.694
	Present	14	16.5	71	83.5	85	100		
	All	46	18.4	204	81.6	250	100		
Anticoagulant therapy	Absent	46	18.7	200	81.3	246	100	Fisher'sExact	1
	Present	0	0.0	4	100.0	4	100		
	All	46	18.4	204	81.6	250	100		
Renal anomaly	Absent	39	16.8	192	83.1	231	100	Fisher'sExact	0.057
	Present	7	36.8	12	63.1	19	100		
	All	46	18.4	204	81.6	250	100		
Stone opacity	Opaque	37	17.1	179	82.9	216	100	1.1	0.291
	Non- opaque	9	26.5	25	73.5	34	100		
	All	46	18.4	204	81.6	250	100		
Size of access sheath	11.5 Fr	28	18.1	127	81.9	155	100	0	0.995
	14 Fr	18	18.9	77	81.1	95	100		
	All	46	18.4	204	81.6	250	100		
Postop J-stenting	Absent	9	15.8	48	84.2	57	100	0.14	0.701
	Present	37	19.2	156	80.8	193	100		
	All	46	18.4	204	81.6	250	100		
Initial residual fragments	Absent	27	15.4	148	84.6	175	100	2.8	0.094
	Present	19	25.3	56	74.7	75	100		
	All	46	18.4	204	81.6	250	100		
Final residual fragments	Absent	31	15.5	168	84.4	199	100	4.3	0.038
	Present	15	29.4	36	70.5	51	100		
	All	46	18.4	204	81.6	250	100		

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Table 1. Associated factors with renal colic on the day of RIRS (continued)

		Groups						Chi-Square Analysis	
		Group I		Group II		Total			
		n	%	n	%	n	%	Chi-Square	p
Bleeding	Absent	44	18.2	197	81.8	241	100	Fisher'sExact	0.673
	Present	2	22.2	7	77.8	9	100		
	All	46	18.4	204	81.6	250	100		
Fever / Infection	Absent	42	17.6	197	82.4	239	100	Fisher'sExact	0.123
	Present	4	36.4	7	63.6	11	100		
	All	46	18.4	204	81.6	250	100		
Ureteral injury	Absent	38	18.4	169	81.6	207	100	0	1
	Present	8	18.6	35	81.4	43	100		
	All	46	18.4	204	81.6	250	100		

RIRS: retrograde intrarenal surgery

in Group I. Mean sheath times were 46.57 min (15-110 min) and 41.54 min (15-140 min) in Groups I and II, respectively ($p<0.05$) (Tables 1 and 2). Mean operative times were 55.13 min (30-120 min) and 55.7 min (20-165 min), respectively ($p>0.05$) (Table 2).

Major complications as classified according to Satava III or Clavien III–V criteria did not occur in the study group. Grade I ureteral injury was experienced in 8 (17.4%) and 35 patients (17.1%) in Groups I and II, respectively ($p>0.05$) (Table 1).

The presence of ureteral J stents implanted pre-and postoperatively did not affect postoperative pain, and severity of postoperative pain was statistically comparable between two groups ($p>0.05$). In addition, the presence of preoperative hydronephrosis, the history of SWL, postoperative fever and macrosopic hematuria did not significantly differ between the two groups ($p>0.05$). Although 4 patients in Group II were using an anticoagulant therapy during the surgery, postoperative macroscopic hematuria did not statistically differ between two groups (3.4% vs. 4.3%) ($p>0.05$) (Tables 1 and 2).

Postoperative hospitalization time was significantly higher in patients with severe renal pain (1.5 days (1-5) vs. 1.1 days (1-2) in Groups I and II, respectively) ($p<0.05$) (Table 2).

Discussion

With rapid advancements in the technology of flexible ureteroscopes in recent years, the size of the flexible ureteroscopes got smaller with improved deflection mechanism. Thus RIRS became a common endourologic procedure for the treatment of renal stones with high success rates.[1-6]

The RIRS procedure can be considered as a safe method due to rarely occurence of major complications as classified according to Satava III or Clavien III-V criteria.[7,8] Only a limited number of studies so far have investigated the complications developed after RIRS, and they only presented some severe complications of the procedure.[3,5,6] But none of them investigated the postoperative pain as a complication, because it is a rather subjective symptom. A classification system has been used for categorizing intraoperative complications of RIRS by using modified Satava classification system for the first time, recently[7], however because the study was designed in a retrospective nature, colic pain was not evaluated as a complication. To our knowledge, there is not any publication focusing on the postoperative pain and associated factors after flexible ureteroscopy, and the present one is the first study about this topic.

Postoperative severe pain might be an important entity for patients undergoing urologic procedures especially when it is recalcitrant in spite of analgesic usage. Some authors have investigated the pain after different urological procedures such as percutaneous nephrolithotomy, robot-assisted radical prostatectomy or pyeloplasty, recently.[9-11] Zargar-Shoshtari et al.[12] showed that the main reason for re-consulting to the hospital after ureteroscopy was the pain. Singh et al.[13] presented that pain score on postoperative first and second day was significantly higher in patients who underwent RIRS compared to the SWL. But when the international literature is investigated, the associated factors with pain after flexible ureteroscopy still remain unclear. The effect of a ureteral J-stent on postoperative pain inserted at the end of the operation is still a matter of debate. Mustafa showed that applying an ureteral stent decreased the postoperative pain in a limited numbers of patients (n=27).[14] Torricelli et al.[15] evaluated patients with (n=51) and without

Table 2. Factors associated with renal colic on the day of RIRS

								Mann-Whitney U test		
	Groups	**n**	**Mean**	**Median**	**Minimum**	**Maximum**	**SD**	**Mean Rank.**	**z**	**p**
Stone size	Group I	46	16.87	15.0	5.0	48.0	7.2	169.0	-4.5	0.0001
	Group II	204	12.60	11.0	5.0	40.0	5.1	115.7		
	All	250	13.38	12.0	5.0	48.0	5.7			
No. Stones	Group I	46	1.54	1.0	1.0	6.0	1.0	124.6	-0.018	0.986
	Group II	204	1.52	1.0	1.0	6.0	1.0	124.5		
	All	250	1.53	1.0	1.0	6.0	1.0			
Sheath time	Group I	46	46.57	45.0	15.0	110.0	18.3	145.3	-2.1	0.039
	Group II	204	41.54	40.0	15.0	140.0	16.3	121.0		
	All	250	42.47	40.0	15.0	140.0	16.8			
Duration of surgery	Group I	46	55.13	50.0	30.0	120.0	18.8	125.7	-0.017	0.986
	Group II	204	55.70	50.0	20.0	165.0	21.0	125.5		
	All	250	55.59	50.0	20.0	165.0	20.6			
Hospital time	Group I	46	1.5	1	1	5	1.0	146.3	-3.99	0.0001
	Group II	204	1.1	1	1	4	0.4	120.2		
	All	250	1.2	1	1	5	0.6			
Analgesic dose	Group I	46	2.6	3	1	5	0.9	202.5	-8.37	0.0001
	Group II	204	1.1	1	0	4	0.8	108.1		
	All	250	1.4	1	0	5	1.0			
BMI	Group I	46	27.6	28.0	16.1	36.7	4.7	131.7	-0.929	0.353
	Group II	204	27.2	27.2	17.0	38.8	4.3	120.6		
	All	250	27.3	27.2	16.1	38.8	4.4			

BMI: body mass index; RIRS: retrograde intrarenal surgery; SD: standard deviation

(n=51) postoperatively implanted J-stents. They found that ureteral J-stent reduced the postoperative pain significantly. In contrast, Byrne et al.[16] showed in their randomized prospective study that flank discomfort was significantly less common in patients without implanted stents as evaulated on the day of surgery, postoperative first and sixth days. According to our resuls, pre-stenting and post-stenting the ureter did not affect postoperative pain (p>0.05). In addition, postoperative macroscopic hematuria, and preoperative hydronephrosis were not associated with postoperative pain (p>0.05). Another important finding of our study was that ureteral injury was not also associated with the postoperative pain. None of the patients experienced high grade (grades 2-4) ureteral injury as described by Traxer and Thomas.[17] Besides, rates of grade 1 injury did not significantly differ between the two groups (p>0.05).

According to our results, patient-stone-and operation-related factors were associated with postoperative pain. The most important patient-related factor was female gender. Tighe et al.[18] showed that female patients had greater mean pain scores on postoperative day 1 for a variety of surgical procedures, with an overall odds ratio of 1.16. Our study also demonstrated that female gender was significantly associated with postoperative pain after RIRS on the operation day. Male/female ratio was 0.7 and 1.7 in Groups I and II, respectively. While in our study group 27.9% of the female, and 11.6% of the male patients postoperatively experienced severe renal colic (p<0.05). According to logistic regression analysis results, female gender increased the risk of pain 3.6-fold.

Although the renal anomaly was detected higher in patients with severe pain (15.2% vs. 5.9%) and led to a 2.6-fold increase in postoperative pain, it was not statistically significantly different between groups (p=0.057). The only stone-related factor associated with postoperative pain was the stone size. The mean stone burden was significantly larger in patients with severe pain (16.87 mm vs. 12.6 mm), and 1 mm increase of stone diameter increased the risk for postoperative pain for 1.15-fold. Other stone-related factors such as number, side, location and opacity of the stones did not affect the postoperative pain.

When the operation-related factors were investigated, preoperative and postoperative ureteral stenting, size of ureteral

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access sheath and ureteral injury were not detected as predictors for pain. The only operation-related factor was the sheath time. But the operation time was not associated with post-RIRS pain. The initial and final procedural success rates in our series were 70% and 79.6%, respectively. While the initial , and final procedural success rates were 58% and 72.5% vs 67.4% and 82.4% in Groups 1, and II, respectively (for both, p>0.05). Higher residual stone fragment rate was detected in patients with severe pain.

The major limitation of the study is that, although ours was a prospective study, CT was not used routinely to detect residual fragments after the surgery to avoid radiation exposure. Despite the shortcomings, this is an important study to be considered as a guidance for further investigations needed about postoperative pain after the RIRS procedure.

Postoperative pain is an important entity that the surgeons have to be aware of. According to our results, patient-, stone- and operation-related factors associated with the early postoperative pain after RIRS were female gender, stone size and the sheath time.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Keçiören Training and Research Hospital.

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

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