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An Exploration of Factors That Cause the Spontaneous Migration of Double-J Stents After Retrograde Intrarenal Surgery

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ABSTRACT

Objective: Retrograde intrarenal surgery (RIRS) is a minimally invasive and relatively new method of treatment for kidney stones. We aimed to identify the factors that cause stent migration in patients who have undergone RIRS to treat kidney stones.

Materials and Methods: Four hundred and twenty-eight patients who underwent RIRS to treat kidney stones that were less than 2 cm in size and had JJ stents inserted intraoperatively between December 2013 and December 2017 were included in this study. For each patient, demographic data and, if present, JJ stent migration direction and postoperative complications were recorded. Twenty-eight patients who experienced JJ stent migration (group 1) and 400 patients who did not experience the migration (group 2) were compared.

Results: Postoperative complications developed in a total of 39 (9.1%) patients. Seventeen complications were evaluated as minor (Clavien 1–2) and 22 (5.1%) were evaluated as major. Almost all of the major complications (n=21) were found to be associated with JJ stent migration. Urosepsis was detected in only one patient (Clavien 4). The mean ages in groups 1 and 2 were 45.4±17.3 years and 44.3±15.1 years, respectively. The mean stone size in group 1 was 16.9±3.0 mm, whereas it was 14.2±5.3 mm in group 2 (p=0.031). A comparison of both the groups showed that the likelihood of an occurrence of JJ stent migration increased significantly with the degree of hydronephrosis (p<0.001).

Conclusion: JJ stent migration after RIRS increases the rate of major complications. An association was detected between JJ stent migration and an increase in stone size and the degree of hydronephrosis.

Keywords: RIRS, JJ stent migrations, kidney stone disease

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INTRODUCTION

With the advancement of technology, extracorporeal shock wave lithotripsy (SWL), percutaneous nephrolithotomy (PNL), and retrograde intrarenal surgery (RIRS) have emerged as treatment modalities for kidney stones. As a result, open surgery has been abandoned (1–3). The goal of treating kidney stones is to minimize trauma caused by surgery in patients, rescue the patients from the stone, and prevent the formation of new stones (4, 5). Endoscopic miniaturization, advances in the optical quality of deflection mechanisms, and laser technology have increased the use of ureterorenoscope for the treatment of ureteral and kidney stones. These innovations have resulted in a widespread use of RIRS as a treatment method for kidney stones and as a viable alternative to other treatment methods (6, 7). Nevertheless, RIRS is a minimally invasive treatment method and serious complications may arise intraoperatively or postoperatively.

The objective of the current study was to identify factors that caused double-J stent migration in patients who underwent RIRS to treat kidney stones that were identified in the follow-up period.

MATERIALS and METHODS

Patient Selection

The data of 1482 patients who underwent surgery in our clinic for kidney stone disease between December 2013 and December 2017 were evaluated retrospectively. Four hundred and twenty-eight patients who underwent RIRS to treat kidney stones measuring ≤2 cm in size or because of failed SWL and who had double-J stents intraoperatively inserted were included in the study. Preoperative noncontrast-enhanced computed tomography (CT) and standard urine culture investigations were performed for each patient. Plain radiography of the kidneys, ureters, and bladder (KUB) was performed for each patient on the first day after the operation. The patients were discharged from the hospital after ensuring that the double-J stents are at their normal position. Patients with a history of stone surgery or who had a double-J stent inserted previously, in addition to pediatric patients aged ≤18 years and the patients with urinary system congenital anomalies such as horseshoe kidney (n=7), duplicated collecting system (n=3), and pelvic kidney (n=2), were excluded from the study.

Operational Technique

The procedure was performed under general anesthesia with the patient placed in the lithotomy position. A hydrophilic guidewire with a diameter of 0.035 mm and a length of 150 cm was advanced under fluoroscopic guidance. The ureter of the kidney designated for surgery was evaluated using a semi-rigid, flexible ureterorenoscope (Karl Storz Flex-X2®). Thereafter, a 10/12-Fr (inner/outer diameter) access sheath was advanced over the guidewire with fluoroscopic guidance. A 4.7-Fr, 26-cm polyurethane double-J stent was inserted in each patient scheduled for intraoperative double-J stent insertion. Both the upper and lower ends of the double-J stent were seen to form a complete loop during the intraoperative period on fluoroscopy.

The patients who were admitted to our clinic with various symptoms such as pain, hematuria, and renal colic or during standard follow-up within one month postoperatively and who showed proximal or distal migration of the DJ stent on KUB radiography were included in the study.

Age, sex, body mass index (BMI), the planned intervention site (right or left), stone size, degree of hydronephrosis, and, if present, the direction of the double-J stent migration were evaluated retrospectively. The degree of hydronephrosis was evaluated by experienced urologists before the operation.

Hydronephrosis was classified as:

- grade 0: no dilatation,
- grade 1: pelvic dilatation only,
- grade 2: mild calyceal dilatation,
- grade 3: severe calyceal dilatation, and
- grade 4: renal parenchymal atrophy.

Postoperative complications identified in patients who underwent RIRS were categorized in accordance with the Clavien–Dindo classification system (8).

Twenty-eight patients who experienced double-J stent migration (group 1) and 400 patients who did not experience the migration (group 2) were compared. The criterion for success after stone surgery in each group was determined as the detection of stone fragments ≤4 mm in KUB radiography and noncontrast-enhanced CT at one-month follow-up.

For statistical analysis, IBM SPSS Statistics ver. 21 (IBM Co., USA) was used. Distribution of the normality of variables was checked with the Kolmogorov–Smirnov test. Not only descriptive statistical methods (mean, standard deviation), but also Student's t-test was used while comparing quantitative data. Dependent samples were included in the comparison of quantitative data. Pearson's chi-squared test and Fisher's exact test were also adapted during this comparing process. The Pearson correlation test became effective in the evaluation of the linear relation between the quantitative data. P-values <0.05 were considered statistically significant.

RESULTS

The Clavien–Dindo classified complications identified in 428 patients who underwent RIRS are summarized in Table 1. Complications were identified in 39 (9%) patients. Seventeen (4%) of the complications were determined to be minor (grade 1–2) and 22 (5%) were determined to be major. Minor complications included postoperative fever, urinary tract infections, and renal colic in 3, 12, and 2 patients, respectively. Almost all (95%) of the major complications (n=21) were associated with the stent migration. Distal stent migration was identified in 12 patients (grade 3a). The exchange of the double-J stent was performed under local anesthesia. The remaining nine patients (grade 3b) required an intervention under general anesthesia for proximal stent migration. Sepsis was detected in only one patient (grade 4). Repeat interventions were required in 21 of the 28 patients who experienced double-J stent migration. Although distal stent migration was detected in the routine follow-up of seven patients, additional interventions were not required, except for the removal of the double-J stent under local anesthesia.

Table 1. Complications detected in the post-operative period in accordance with the Clavien-Dindo classification system

Clavien-Dindo classification	Complication	n	%
Clavien 1	Fever	3	0.7
Clavien 2	Urinary system infection	12	2.8
	Renal colic	2	0.5
Clavien 3a	Distal stent migration	12	2.8
Clavien 3b	Proximal stent migration	9	2.1
Clavien 4	Urosepsis	1	0.2
Total		39	9.1

The ratio of women to men was 10:18 in group 1 and 168:232 in group 2. The mean ages in groups 1 and 2 were 45.4±17.3 years and 44.3±15.1 years, respectively. The mean BMI was 27.5±2.5 kg/m^2 in group 1 and 27.0±3.2 kg/m^2 in group 2. The sex, age, and BMI values were found to be similar in both the groups (p=0.524, p=0.930, and p=0.441, respectively). The mean stone size in group 1 was 16.9±3.0 mm, compared to 14.2±5.3 mm in group 2 (p=0.031). The increase in double-J stent migration was found to have a statistically significant correlation with the extent to which an increase in hydronephrosis occurred in both the groups (p=0.001) (Table 2). The grade of hydronephrosis was correlated with the stent migration (Pearson correlation 0.132, p=0.007).

DISCUSSION

Although RIRS is a minimally invasive technique, serious complications, such as massive bleeding or sepsis, can occur after surgery (9). Complications were identified in 39 (9%) of the 428 patients who underwent RIRS for the management of kidney stones in the present study, of which 5% were major. Complications were seen to develop in 48 (10%) of 454 patients who underwent PNL and RIRS in the study by De et al. (10). In another research, the rate of major complications after RIRS was 2% (8 patients). Six patients underwent interventions under general anesthesia because of stones in the urinary tract (11). Twenty-one patients (5%) required additional interventions under general or local anesthesia in this study. After double-J stent migration, postoperative urosepsis was detected in only one patient in group 1.

Table 2. Comparison of patients with or without JJ stent migration

	Group 1 (n=28)		Group 2 (n=400)		p
	n	%	n	%	
Age (years)	45.4±17.3		44.3±15.1		0.793
Female/male (n)	18/10		232/168		0.524
BMI (kg/m^2)	27.5±5.5		27±3.2		0.441
Height (cm)	166.9±7.9		166.4±7.2		0.232
Laterality (right/left)	16/12		207/193		0.581
Stone size (mm)	16.9±3.0		14.2±5.3		**0.031**
Stone location					
Renal pelvis	13	46.4	208	52	0.638
Upper calyx	4	14.3	48	12	
Middle calyx	5	17.9	90	22.5	
Lower calyx	6	21.4	54	13.5	
Hydronephrosis grade					
Grade 0	10	35.7	143	35.8	**<0.001**
Grade 1	2	7.1	132	33	
Grade 2	9	32.1	101	25.2	
Grade 3	5	17.9	23	5.8	
Grade 4	2	7.1	1	0.2	
Success	23	82.1	320	80	0.783

BMI: Body mass index; kg: Kilogram; m: Meter; cm: Centimeter; mm: Millimeter

The rate of double-J stent migration range from 2% to 10% as seen in the literature (12, 13). A stent migration rate of 7% in the RIRS postoperative period was found in the present study. There is a broad range of use for double-J stents in urological pathology and reports of complications have increased in relation to the growing use of double-J stents. Complications include broken stents, stent migration, stone formation, and encrustation. When a double-J stent has been in place for ≥6 months, a highly complex endourological approach to treatment is required (14).

Stent-associated symptoms, such as increased urinary urgency or frequency, hematuria, and renal colic, are frequently reported owing to irritation of the urinary tract and significantly decreased quality of life of patients (15–17). Symptomatic stent migration in early postoperative period can also occur. Stent exchange under local anesthesia may be required with distal stent migration. However, anesthesia is required to manage proximal stent migration. The spontaneous removal of stents from the body has been observed in relation to asymptomatic and distally migrating stents. This occurred in seven patients, without other symptoms, in our study.

An association was found between stent migration and an increase in the degree of hydronephrosis and stone size ($p<0.001$ and $p=0.031$, respectively). Increased stone size and degree of hydronephrosis could facilitate migration by decreasing the degree of attachment of stents. The measurement of ureteral length during the selection of stent length was determined to be important in the study by Breau et al. and proximal migration generally occurred when the length of the stent was too short for the ureter (18). In another study, the selection of a double-J stent in accordance with the height of the patient had been proposed. It was recommended that stents measuring 24–26 cm should be used in patients who are taller than 175 cm (19). The proximal and distal migration of double-J stents with double-sided loops through the entire ureter can be elucidated as easy mobilization within a dilated system.

To prevent stent migration, several performances, such as the use of self-expandable metallic stents, have been tried in the past. Although physical barriers were effective in preventing stent migration, stent insertion was too difficult (20, 21). Polyurethane stents have frequently been used in urological practice, because they are economical and easily applied. Materials involving the use of biomechanical memory can prevent stent migration by preserving the position of the stent (15). In the present study, standard 4.7-Fr, 26-cm polyurethane stents were used in patients who underwent RIRS.

The limitation of this study was that ureter dimensions and length were not calculated using CT. Standard stents of the same length were used for all patients. In addition, no difference was observed in the heights of the patients categorized into two groups.

Increased stone size and degree of hydronephrosis were related to double-J stent migration in the current study. Although double-J stent migration after RIRS is a rare complication, it is an important factor to consider because it affects the quality of life in the postoperative period and a secondary surgical intervention may be required. It was observed that most of the major complications were developed because of stent migration. General anesthesia was required in some patients who experienced stent migration. It should be kept in mind that patients with a high degree of hydronephrosis may have stent migration in the early postoperative period.

CONCLUSION

Double-J stent migration experienced after RIRS increases the rate of major complications in patients. A correlation was found in the current study between double-J stent migration and degree of hydronephrosis.

Ethics Committee Approval: İstanbul Medeniyet University Göztepe Training and Research Hospital Clinical Research Ethics Committee granted approval for this study (Date: 11.10.2017, No: 2017/0300).

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

Peer-review: Externally peer-reviewed.

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REFERENCES

1. Danuser H, Müller R, Descoeudres B, Dobry E, Studer UE. Extracorporeal shock wave lithotripsy of lower calyx calculi: how much is treatment outcome influenced by the anatomy of the collecting system? Eur Urol 2007; 52(2): 539–46. [CrossRef]
2. Yildirim A, Senkul T, Sarica K, Öztürk M, Gürbüz C, Ates F, et al. Have the technological advancements changed the distribution of treatment modalities in urolithiasis? European Urology Supplements 2011; 10(7): 516–7. [CrossRef]
3. Argyropoulos AN, Tolley DA. Evaluation of outcome following lithotripsy. Curr Opin Urol 2010; 20(2): 154–8. [CrossRef]
4. Zheng C, Xiong B, Wang H, Luo J, Zhang C, Wei W, et al. Retrograde intrarenal surgery versus percutaneous nephrolithotomy for treatment of renal stones> 2 cm: a meta-analysis. Urol Int 2014; 93(4): 417–24.
5. Giusti G, Proietti S, Luciani LG, Peschechera R, Giannantoni A, Taverna G, et al. Is retrograde intrarenal surgery for the treatment of renal stones with diameters exceeding 2 cm still a hazard? Can J Urol 2014; 21(2): 7207–12.
6. Türk C, Petrik, Skolarikos A, Neisius A, Petrik A, Seitz C, et al. Guidelines on urolithiasis. European association of urology 2017 [cited 2017 10.12.2017]. Available from: URL: http://uroweb.org/guideline/urolithiasis/.
7. Breda A, Angerri O. Retrograde intrarenal surgery for kidney stones larger than 2.5 cm. Curr Opin Urol 2014; 24(2): 179–83. [CrossRef]
8. Dindo D, Clavien PA. What is a surgical complication? World J Surg 2008; 32(6): 939–41. [CrossRef]
9. Oguz U, Resorlu B, Ozyuvali E, Bozkurt OF, Senocak C, Unsal A. Categorizing intraoperative complications of retrograde intrarenal surgery. Urol Int 2014; 92(2): 164–8. [CrossRef]
10. De S, Autorino R, Kim FJ, Zargar H, Laydner H, Balsamo R, et al. Percutaneous nephrolithotomy versus retrograde intrarenal surgery: a systematic review and meta- analysis. Eur Urol 2015; 67(1): 125–37.
11. Xu Y, Min Z, Wan SP, Nie H, Duan G. Complications of retrograde intrarenal surgery classified by the modified Clavien grading system. Urolithiasis 2018: 46(2): 197–202. [CrossRef]
12. Damiano R, Oliva A, Esposito C, De Sio M, Autorino R, D'Armiento M. Early and late complications of double pigtail ureteral stent. Urol Int 2002; 69(2): 136–40. [CrossRef]
13. Hao P, Li W, Song C, Yan J, Song B, Li L. Clinical evaluation of double-pigtail stent in patients with upper urinary tract diseases: report of 2685 cases. J Endourol 2008; 22(1): 65–70. [CrossRef]
14. Ray RP, Mahapatra RS, Mondal PP, Pal DK. Long-term complications of JJ stent and its management: A 5 years review. Urology Annals 2015; 7(1): 41–5. [CrossRef]
15. Saltzman B. Ureteral stents. Indications, variations, and complications. The Urologic clinics of North America 1988; 15(3): 481–91.
16. Joshi HB, Stainthorpe A, Keeley FX Jr, MacDonagh R, Timoney AG. Indwelling ureteral stents: evaluation of quality of life to aid outcome analysis. J Endourol 2001; 15(2): 151–4. [CrossRef]
17. Joshi H, Okeke A, Newns N, Keeley FX Jr, Timoney AG. Characterization of urinary symptoms in patients with ureteral stents. Urology 2002; 59(4): 511–6. [CrossRef]
18. Breau RH, Norman RW. Optimal prevention and management of proximal ureteral stent migration and remigration. J Urol 2001; 166(3): 890–3. [CrossRef]
19. Ho CH, Huang KH, Chen SC, Pu YS, Liu SP, Yu HJ. Choosing the ideal length of a double-pigtail ureteral stent according to body height: study based on a Chinese population. Urol Int 2009; 83(1): 70–4.
20. Siegel JF, Smith AD. The ideal ureteral stent for antegrade and retrograde endopyelotomy: what would it be like? J Endourol 1993; 7(2): 151–4. [CrossRef]
21. Gibbons RP. Gibbons ureteral stents. Urol Clin North Am 1982; 9(1): 85–8.