Yeni Üroloji Dergisi - *The New Journal of Urology* **2023;18(1):48-54. doi: 10.33719/yud.2023;18-1-1188129**

Original Research / Özgün Araştırma

Long-term stone-free rates after flexible URS: Does the size of DJ stent affect the outcomes

Flexible URS sonrası uzun dönem taşsızlık oranları: DJ-stentin boyutu sonuçları etkiliyor mu?

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Geliş tarihi (Submitted): 2022-10-12
Kabul tarihi (Accepted): 2022-12-19

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Özet

Amaç: Bu çalışmada, kullanılan double- J (DJ) stent çapının, flexible üreteroskopik (fURS) böbrek taşı tedavisinin taşsızlık oranları ve postoperatif ağrı durumuna olası etkisini araştırdık.

Gereç ve Yöntemler: Böbrek taşı nedeniyle fURS uygulanan toplam 104 hasta çalışmaya dahil edildi. Taş tedavisi sonrası 51 hastaya 4.7 Fr DJ stent takılırken, 53 hastaya 6 Fr stent takıldı. Postoperatif 3. ayda kontrastsız bilgisayarlı tomografi ile incelenen taşsızlık durumuna ek olarak, iki grubun genel ağrı semptomları, postoperatif ilk haftayı takiben uygulanan görsel ağrı skalası ile değerlendirildi. Başarı, taşların tamamen temizlenmesi veya küçük taş parçalarının (<3 mm) varlığı olarak belirlendi.

Bulgular: İki grubun genel ağrı semptomları, görsel ağrı skalası kullanılarak ölçüldüğünde 6 Fr grubu daha öndeydi (4.02±1.10 vs 4.81±1.53, p=0.006). İki grup taşsızlık oranları açısından anlamlı fark göstermedi (%84.3 vs %74.5, p=0.264). İki grup arasında postoperatif ateş, stent migrasyonu veya acil servis ziyaretleri açısından istatistiksel olarak anlamlı bir fark bulunamadı.

Sonuç: Bu çalışma, daha büyük çaplı stentlerin hastalarda daha yüksek ağrı şikayetlerine neden olmasına rağmen, uzun süreli taşsızlık oranlarını önemli ölçüde etkilemediğini belirledi. Flexible üreteroskopik cerrahi sonrası stent seçimi söz konusu olduğunda 6 Fr yerine 4.7 Fr DJ tercih edilmelidir.

Anahtar Kelimeler: Double j stent çapı, böbrek taşı, fleksible üreterorenoskopi, taşsız

Abstract

Objective: This study's main goal was to evaluate the possible impact of different-sized double-J (DJ) stents on the pain and stone-free status following flexible ureteroscopic laser disintegration (fURS) of renal stones.

Material and Methods: A total of 104 patients who underwent fURS for kidney stones were included in our study. In 51 patients, a 4.7 Fr DJ stent was used after stone fragmentation, while in the remaining 53 cases, a 6 Fr stent was chosen. Between the two groups, general pain symptoms were evaluated using a visual pain scale at the end of the first postoperative week. The stone-free status was evaluated using non-contrast computed tomography (NCCT) after three months following surgery. Success was determined by either the complete clearance of the stones or the presence of small stone fragments (<3 mm).

Results: Using a visual pain scale, we compared the two groups' overall reports of pain (4.02±1.10 vs 4.81±1.53, p=0.006). When we looked at the stone-free rates, the two groups were not significantly different in this regard (84.3% vs 74.5%, p=0.264). We found no statistically significant difference between the two groups in terms of postoperative fever, stent migration, or visits to the emergency room.

Conclusion: In spite of the fact that larger diameter stents resulted in more pain complaints for patients, they did not alter the long-term stone-free rates appreciably, as evidenced by our findings. In order to reduce the occurrence of unpleasant symptoms, a 4.7 Fr double-j stent may be preferable over a 6 Fr stent following flexible ureteroscopic surgery.

Keywords: Double-j stent diameter, renal stones, flexible ureterorenoscopy, stone free

The study was approved by Kafkas University Ethics Committee in February 23, 2022. Approval no is 02.
All research was performed in accordance with relevant guidelines/regulations, and informed consent was obtained from all participants.

INTRODUCTION

Management of symptomatic urinary stones has changed dramatically due to the advances in instrumentation and technology during the last three decades (1). Thanks to these advancements, minimally invasive treatment options, including extracorporeal shockwave lithotripsy (ESWL), flexible ureteroscopy (fURS), and percutaneous lithotripsy (PNL), have effectively replaced open surgery due to their relatively safe and successful outcomes (2). PCNL has been performed in the management of large stones (> 20 mm) with significantly higher stone-free rates (SFR) in a single session, whereas SWL and fURS have been well-performed to manage medium-sized stones (10-20 mm) due to their relatively less invasive nature with comparable success rates to PCNL (3). The European Association of Urology (EAU) Urolithiasis Guidelines acknowledge SWL and fURS as equally effective treatment methods for kidney stones smaller than 20 mm; PCNL is still indicated as the first-line treatment for stones greater than 20 mm in diameter(4).

In the last two decades, fURS has become a safe and successful treatment for medium-sized kidney stones, particularly with the advent of newer-generation flexible ureteroscopes and the practical application of the Ho-YAG laser for stone disintegration. In these stones, the safe and practical application of holmium laser lithotripsy has produced superior outcomes to that of SWL. Comparable complications and stone-free rates have been seen for these stones in comparison to PNL and SWL, two other potential management options (5).

However, based on the department's established clinical practice and the surgeon's option, a ureteric DJ stent may be placed to drain the affected upper urinary tract. Stenting has been demonstrated to avoid ureteral blockage caused by post-procedure mucosal edema, clots, and stone fragments. In addition, it decreases pain and reduces the risk of renal functional degradation by maintaining an open lumen (6,7). In spite of these benefits, side effects such as lower urinary tract symptoms (LUTS), sexual dysfunction, poor work performance, flank and/or body discomfort, and hematuria may occur after DJ insertion (8). Studies examining the advantages and disadvantages of stents based on stent diameter (particularly 4.7-5 French (Fr) and 6 Fr DJ stents) indicated that stents with smaller diameters were better tolerated with less pain and patient discomfort. Additionally, several investigations have suggested that relatively tiny stents may be more prone to upward migration (9). To our knowledge, however, there is not enough information in the literature to make a conclusion about the potential impact of various DJ stent diameters on long-term stone-free status following fURS.

The study being presented compares post-fURS complications dependent on stent size and evaluates whether ureteral stents have an effect on long-term stone-free rates.

We have shown a preventive effect of MK on gentamicin-induced nephrotoxicity in our previous experimental study (10). We consider that MK may show similar protective effect against APAP nephrotoxicity. Therefore, we examined the protective effect of MK on APAP-induced renal injury in experimental models.

MATERIAL AND METHODS

Between October 2020 and February 2022, 105 uncomplicated fURS procedures were conducted at our clinic to treat kidney stones. This study program contained the data from these procedures. All participants gave their consent in writing after being fully informed. Our investigation was authorized by the local ethics committee of our institute (Approval file number: 80576354-050-99/44). The Declaration of Helsinki and the ethical guidelines for human experimentation established by the regional ethics council were followed in every instance. All patients underwent low-dose non-contrast computerized tomography (NCCT) and kidney-ureter-bladder radiography (KUB) as part of their preoperative evaluation in addition to blood and urine analyses (including a culture sensitivity test). Patients with acute renal failure, a history of ureteral stenosis, or bilateral stones were not included in the study. A further exclusion criterion was the insertion of a DJ stent prior to surgery. Patients with urinary tract infections were treated with antibiotics prior to surgery. Patients were prospectively divided into two groups based on the stent diameters following fragmentation. One group consisted of pa-

tients who had received a 4.7 Fr DJ stent, and the other consisted of patients who had received a 6 Fr DJ stent.

During a Surgical Procedure

Second-generation cephalosporins were administered 30 minutes prior to the surgery as the appropriate antibiotic for prophylaxis. All procedures were performed under general anesthesia. In the lithotomy position, a 0.038 Fr guide wire was implanted into the renal pelvis via a 9.5 Fr semi-rigid ureteroscopy under fluoroscopic guidance. The pelvicalyceal system was evaluated by retrograde pyelography. A ureteral access sheath (9.5/11.5 Fr, Cook Medical, Bloomington, IN) was placed under fluoroscopy. The collecting system was entered with a 7.5 Fr fiber optic flexible ureteroscope (Storz FLEX-X2). To disintegrate stones, we utilized a holmium laser equipped with a 273 fiber and used high energy-low frequency settings (1-1.2 J and 6-10 Hz). After laser lithotripsy was completed, stone particles smaller than 2 mm were left for spontaneous passage. A nitinol basket (ZeroTipTM; Cook Urological Inc.) was used to retrieve fragments greater than 3 mm. All patients were subsequently implanted with two different-sized DJ stents (4.7 F and 6 F) after the operation. On the first postoperative day, KUB was used to assess the location of the stents. Antibiotics and nonsteroidal anti-inflammatory drugs were administered to all patients after surgery. Patients were only given access to nonsteroidal anti-inflammatory drugs for a total of three days. This method was used to ensure that the analgesic medicine wouldn't affect the pain assessment at the end of the first postoperative week.

Postoperative Follow-up

One week after their operations, the patients were seen in the outpatient clinic for follow-up evaluations. In addition to answering questions about their symptoms, patients were also asked to rate their pain on a 10-cm visual analog scale (VAS). Following three weeks after the procedure, all DJ stents were extracted. Stone-free status was assessed using low-dose, non-contrast computed tomography after three months following surgery. For this purpose, success was defined as either the complete absence of remaining fragments or the presence of very small stone fragments (<3 mm).

Statistical evaluations were performed using SPSS 22.0. (SPSS Inc, Chicago, IL, USA). The normality of the distribution between groups was evaluated using the Kolmogorov-Smirnov test. The normally distributed means were compared using a Student t-test on independent samples. The Mann-Whitney U test was used to compare non-normally distributed means. The Chi-square or Fisher's exact test was employed for categorical variable analysis. A p-value of 0.05 or lower was considered statistically significant.

RESULTS

Our sample size was 104 patients. The 4.7 Fr group consisted of 51 patients, while the 6 Fr group comprised 53 patients. Mean age (51.18±16.23 vs 55.19±15.30, p=0.354) and gender distribution were found to be similar between the two groups Preoperative evaluations showed no statistically significant differences in the prevalence of diabetes mellitus, Charlson Comorbidity Indexes, or ASA scores between the two groups. Again, there was no discernible difference in terms of number, lateralization, pelvicalyceal position, or opacity of stones between the two groups. Further, there was no significant difference between the groups with regard to the presence/grade of hydronephrosis, the infundibulopelvic angle, or the use of anticoagulants. When comparing the two groups before and after surgery, there was no discernible difference in hemoglobin or creatinine levels. Table 1 provides demographic and laboratory results for the two groups.

Hospital stay, fever, emergency room visits, and stent migration rates were comparable between the two groups in the postoperative period. While VAS scores were recorded for both groups, the 6 Fr group had a much higher mean value (4.02±1.10 vs 4.81±1.53, p=0.006). Third-month stone-free rates after surgery were comparable between the groups, which is an important parameter (84.3 % vs 74.5 %, p=0.264). Postoperative follow-up data of the patients are given in Table 2.

DISCUSSION

After the endoscopic treatment of reno-ureteral stones, a ureteral stent is placed in a certain percentage of patients in order to prevent ureteral obstruction caused by stone fragments, edema, or clots. Also,

Table 1. Patient characteristics and laboratory findings

		4.7 Fr		6 Fr		p
Gender	Male	28	54.9%	34	64.2%	0.339
	Female	23	45.1%	19	35.8%	
Age (years)		51.1	±16.2	55.1	±15.3	0.354
ASA score	ASA- 1	28	54.9%	23	43.4%	0.168
	ASA- 2	20	39.2%	23	43.4%	
	ASA-3	3	5.9%	7	13.2%	
Diabetes		3	5.9%	5	9.4%	0.499
Charlson Index [median (IQR)]		1	(0-2)	2	(1-3)	0.104
Stone Lateralization	Right	21	41.2%	28	52.8%	0.236
	Left	30	58.8%	25	47.2%	
Stone Location	Pelvic	31	60.8%	39	73.6%	0.91
	Lower	5	9.8%	3	5.7%	
	Middle	0	0%	2	3.8%	
	Upper	1	2.0%	5	9.4%	
	Multicalyxal	14	27.5%	4	7.5%	
Stone Size (mm)		11.2	±4.3	12.8	±5.7	0.200
Opacity	Opac	34	66.7%	31	58.5%	0.392
	Non-opac	17	33.3%	22	41.5%	
Stone Number	Single	33	64.7%	36	67.9%	0.730
	Multiple	18	35.3%	17	32.1%	
Hydronephrosis		14	27.5%	17	32.1%	0.560
Infundibulopelvic Angle (°)		46.0	±13.0	48.8	±12.6	0.326
Preop hg (gr/dL)		14.2	±1.7	13.9	±1.8	0.266
Preop cr (mg/dL)		0.97	±0.35	1.08	±0.94	0.649
Postop hg (gr/dL)		14.0	±1.9	13.9	±1.6	0.592
Postop cr (mg/dL)		0.88	±.25	0.93	±0.31	0.416
Anticoagulant use		4	7.8%	9	17.3%	0.150
Alfa Blocker Use		3	5.9%	9	17.0%	0.078

ASA: American Society of Anesthesiologists. ***hg:*** *hemoglobin. cr: creatinine.* ***Postop:*** *postoperative.* ***Preop:*** *preoperative.*

Table 2. Postoperative follow-up data

	4.7 Fr (n=51)		6 Fr (n=53)		p
Hospital Stay	2.2	±.0.8	2.4	±1.8	0.412
PO Fever	4	7.8%	3	5.6%	0.658
VAS Score	4.0	±1.1	4.8	±1.5	0.006
Emergency Service Admission	2	3.9%	5	9.4%	0.264
Stent Migration	3	5.8%	1	1.8%	0.292
Stone Free Rate (PO 3. month)	43	84.3%	40	74.5%	0.264

PO: *Post-operative*

it reduces pain and preserves kidney functions (6,7). However, DJ-stent insertion is not routinely recommended in guidelines because it prolongs the operation time and brings additional cost and morbidity. The ultimate decision is left to the operating surgeon (10). Reported study outcomes clearly demonstrate that majority of urologists prefer stenting after fURS to manage small residing fragments and possible edema formation in the ureter due to the ureteral access sheath. A global study reported that the rate of stenting after kidney stone treatment with fURS was 80% (11).

Patients with DJ-stents face problems such as poor quality of life (QoL), lower urinary tract symptoms (LUTS), and body pain during the early postoperative period. In a meta-analysis, it has been well shown that the 6 Fr DJ-stent caused higher pain than smaller-sized stents (12). In the same study, patient ratings on the ureteral stent symptom score (USSQ) were lower for LUTS, general health, and additional problems, when the stent diameter was smaller. In contrast to the study cited above, we employed VAS to measure the degree of pain experienced by individuals after DJ implantation. As a result, our patients who had 6 Fr stents in situ, complained of higher pain throughout the surgical first week of follow-up, and it was consistent with the results of the mentioned meta-analysis. In contrast to our findings, a prior study comparing two stent types (5 Fr vs 6 Fr) with respect to postoperative pain using the VAS score, found no significant difference between the two groups (13).

Our study's primary objective was to assess the potential impacts of two different-sized stents on the patients' final stone-free status after three months of surgery. The long-term stone-free status of patients who underwent fURS treatment for kidney stones was unaffected by the insertion of 4.7 Fr or 6 Fr DJ. The emergency department admission rate was lower in the 4.7 Fr group, even though this difference was not statistically significant. Similar to this, we showed that the rate of stent migration was higher in the DJ group with the smaller diameter, but this difference did not reach the criteria for statistical significance. Our findings were supported by a previous study comparing the migration rates of 4.8 Fr and 6 Fr stents. Small-diameter stents were also more likely to migrate in this study (14).

No statistically significant difference in the incidence of postoperative fever between the two groups could be demonstrated in a randomized prospective study comparing 4.6 Fr and 6 Fr DJ-stents, and the findings of this study largely complied with ours regarding postoperative fever rates (15).

NCCT is regarded as the gold standard for estimating stone-free rates following fURS. In addition, it has been determined that 90 days postoperatively would be the optimal time for this scan (16). In the majority of studies examining the effect of different stent diameters on stone-free rates, postoperative NCCT was not routinely performed, in contrast to our study. This is one of our work's strengths (15,17,18).

LIMITATIONS

Our study's primary and most significant drawback is that it wasn't carried out in a prospective, randomized manner. Our study is retrospective even though stent size was randomly given to all patients included. Another restriction that seems to present is the small number of patients. A further drawback is the absence of a control group of patients who had the operation but were not inserted a DJ-stent. Another restriction is the fact that we were unable to compare the two groups using the USSQ questionnaire. Despite this, numerous studies, including a series of meta-analyses, have thoroughly assessed the effects of various-sized stents on irritative symptoms, quality of life, and other problems. The main goal of our study was to compare how stent size affected rates of final stone-free rates in the 3rd postoperative month. As a result, not using the USSQ score might not be considered a significant restriction.

CONCLUSION

Our findings indicated that a 6 Fr DJ catheter would be less advantageous than a 4.7 Fr one in terms of postoperative pain, which has an impact on patients' quality of life. Furthermore, it has been shown that the incidence of complications, such as fever and migration, is comparable in both groups. Based on our

findings, a smaller stent (4.7 Fr.) may be beneficial with the same stone-free but lower pain rates after surgeries. However, we believe that more randomized controlled trials with larger sample sizes are needed for this area.

Conflict of Interest

The authors declare to have no conflicts of interest.

Financial Disclosure

The authors declared that this study has received no financial support.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

Ethical Approval

The study was approved by Kafkas University Local Ethics Committee (Approval no: 02, Date: 2022/02/23) and written informed consent was received from all participants. The study protocol conformed to the ethical guidelines of the Helsinki Declaration.

Author Contributions

Conception and design, Data acquisition, Data analysis and interpretation, Drafting the manuscript, Critical revision of the manuscript for scientific and factual content, Statistical analysis, Supervision; All authors contributed to this study equally.

REFERENCES

1. Doizi S, Traxer O. Flexible ureteroscopy: technique, tips, and tricks. Urolithiasis 2018;46(1):47–58; doi: 10.1007/S00240-017-1030-X.
2. Singal RK, Denstedt JD. Contemporary management of ureteral stones. Urol Clin North Am 1997;24(1):59–70; doi: 10.1016/S0094-0143(05)70354-2.
3. Quhal F, Seitz C. Guideline of the guidelines: urolithiasis. Curr Opin Urol 2021;31(2):125–129; doi: 10.1097/MOU.0000000000000855.
4. Türk C, Petřík A, Sarica K, et al. EAU Guidelines on Interventional Treatment for Urolithiasis. Eur Urol 2016;69(3):475–482; doi: 10.1016/J.EURURO.2015.07.041.
5. Chung DY, Kang DH, Cho KS, et al. Comparison of stone-free rates following shock wave lithotripsy, percutaneous nephrolithotomy, and retrograde intrarenal surgery for treatment of renal stones: A systematic review and network meta-analysis. PLoS One 2019;14(2); doi: 10.1371/JOURNAL.PONE.0211316.
6. Dellis A, Joshi HB, Timoney AG, et al. Relief of Stent Related Symptoms: Review of Engineering and Pharmacological Solutions. J Urol 2010;184(4):1267–1272; doi: 10.1016/J.JURO.2010.06.043.
7. Liu Q, Liao B, Zhang R, et al. Combination therapy only shows short-term superiority over monotherapy on ureteral stent-related symptoms - outcome from a randomized controlled trial. BMC Urol 2016;16(1):1–8; doi: 10.1186/S12894-016-0186-Y.
8. Giannarini G, Keeley FX, Valent F, et al. Predictors of morbidity in patients with indwelling ureteric stents: results of a prospective study using the validated Ureteric Stent Symptoms Questionnaire. BJU Int 2011;107(4):648–654; doi: 10.1111/J.1464-410X.2010.09482.X.
9. Wu G, Sun F, Sun K, et al. Impact of differential ureteral stent diameters on clinical outcomes after ureteroscopy intracorporeal lithotripsy: A systematic review and meta-analysis. International Journal of Urology 2021;28(10):992–999; doi: 10.1111/IJU.14631.
10. Song T, Liao B, Zheng S, et al. Meta-analysis of postoperatively stenting or not in patients underwent ureteroscopic lithotripsy. Urol Res 2012;40(1):67–77; doi: 10.1007/S00240-011-0385-7/FIGURES/8.
11. Muslumanoglu AY, Fuglsig S, Frattini A, et al. Risks and Benefits of Postoperative Double-J Stent Placement after Ureteroscopy: Results from the Clinical Research Office of Endourological Society Ureteroscopy Global Study. J Endourol 2017;31(5):446–451; doi: 10.1089/END.2016.0827.
12. Wu G, Sun F, Sun K, et al. Impact of differential ureteral stent diameters on clinical outcomes after ureteroscopy intracorporeal lithotripsy: A systematic review and meta-analysis. International Journal of Urology 2021;28(10):992–999; doi: 10.1111/IJU.14631.
13. Kim BS, Choi JY, Jung W. Does a Ureteral Stent with a Smaller Diameter Reduce Stent-Related Bladder Irritation? A Single-Blind, Randomized, Controlled, Multicenter Study. J Endourol 2020;34(3):368–372; doi: 10.1089/END.2019.0482.

14. Damiano R, Autorino R, de Sio M, et al. Does the Size of Ureteral Stent Impact Urinary Symptoms and Quality of Life? A Prospective Randomized Study. Eur Urol 2005;48(4):673–678; doi: 10.1016/J.EURURO.2005.06.006.
15. Nestler S, Witte B, Schilchegger L, et al. Size does matter: ureteral stents with a smaller diameter show advantages regarding urinary symptoms, pain levels and general health. World J Urol 2020;38(4):1059–1063; doi: 10.1007/S00345-019-02829-0.
16. Danilovic A, Cavalanti A, Rocha BA, et al. Assessment of Residual Stone Fragments After Retrograde Intrarenal Surgery. https://home.liebertpub.com/end 2018;32(12):1108–1113; doi: 10.1089/END.2018.0529.
17. Prasanchaimontri P, Nualyong C, Taweemonkongsap T, et al. Impact of Ureteral Stent Size on Stone-Free Rates in Ureteroscopic Lithotripsy for Ureteral Stones: Randomized Controlled Trial. JOURNAL OF THE MEDICAL ASSOCIATION OF THAILAND 2017;100(4):162.
18. Cubuk A, Yanaral F, Ozgor F, et al. Comparison of 4.8 Fr and 6 Fr ureteral stents on stent related symptoms following ureterorenoscopy: A prospective randomized controlled trial. Kaohsiung J Med Sci 2018;34(12):695–699; doi: 10.1016/j.kjms.2018.07.001.