ORIGINAL PAPER

UROLITHIASIS

Comparison of the effects of commonly used double-J stents on stone-free rates and ureteral stent-related symptoms after lithotripsy for upper urinary tract stones

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Introduction Evidence on the impact of different stent sizes on stone-free rate (SFR) and ureteral stent-related symptom questionnaire (USSQ) scores in endoscopic lithotripsy remains limited. This study aimed to evaluate the effects of 2 commonly used double-J stents of different diameters on these outcomes.

Material and methods We retrospectively reviewed 108 patients with upper urinary tract stones who underwent lithotripsy between January 2022 and December 2023. Patients were stratified into 4.7F and 6F groups based on stent diameter. Primary outcomes were SFR at 24 h and 30 days. USSQ scores and complications were compared between groups.

Results SFR was similar between groups at 24 h (52.5% vs 55.1%; p = 0.791) and 30 days (74.6% vs 77.6%; p = 0.719). USSQ scores were comparable (Urinary Symptoms: 29 vs 29, p = 0.473; Body Pain: 12 vs 12.5, p = 0.347; General Health: 13 vs 13, p = 0.706; Work Performance: 8 vs 8, p = 0.072; Sexual Matters: 4 vs 3, p = 0.242; Additional Problems: 12 vs 12, p = 0.485). More patients in the 4.7F group reported hematuria (83.1% vs 69.4%; p = 0.094) and changes in daily work activities. Many experienced body pain (76.9%) and absence of sexual activity (88.9%). No complications exceeded grade II.

Conclusions Both 4.7F and 6F stents showed similar efficacy and safety. Stent size did not significantly impact USSQ scores or SFR.

Key Words: ureteral stents ‹› device size ‹› lithotripsy ‹› urinary calculi ‹› surveys and questionnaires

INTRODUCTION

The double-J stent has been a cornerstone of urological practice since its introduction several decades ago [1]. Its established clinical roles include maintaining urinary drainage; relieving obstruction caused by malignancy or strictures to preserve renal function; reducing iatrogenic injury during endoscopy; managing acute hydronephrosis via decompression; and facilitating staged surgical planning. Although the use of stents for uncomplicated stones remain controversial, most urologists employ them for ureteral dilation, urine drainage, and facilitating fragment passage. However, the optimal stent characteristics to aid stone passage remain unclear, particularly the influence of stent diameter on outcomes. It is also recognized that stents cause postoperative discomfort, raising the question of whether smaller stents can reduce these adverse effects.

The implantation of indwelling ureteral stents is well documented to cause device-related symptoms, including urinary irritation, renal colic, hematuria, and other complications [2]. A persistent

challenge in clinical research has been quantifying stent-associated symptom burden, as evidenced by the previous lack of validated assessment tools before the development of the Ureteral Stent Symptom Questionnaire (USSQ) [3, 4]. The USSQ is a self-administered instrument comprising 6 sections: Urinary Symptoms, Body Pain, General Health, Work Performance, Sexual Matters, and Additional Problems, each scored individually; however, no total score for the entire questionnaire exists.

To our knowledge, this is the first comparative study evaluating the efficacy of 4.7F vs 6F ureteral stents in achieving stone-free rate (SFR) and mitigating stent-related symptoms assessed by the USSQ among patients undergoing endoscopic lithotripsy for 0.6–2 cm upper urinary tract calculi, with the aim of providing evidence-based guidance for clinical decision-making.

MATERIAL AND METHODS

This study included 108 patients with upper urinary tract stones who underwent endoscopic lithotripsy at our hospital's urology center between January 2022 and December 2023. Patients meeting the inclusion criteria were stratified into 4.7F and 6F groups based on the stent diameter used during the procedure. Inclusion criteria were: 1) age >18 years; 2) upper urinary tract stones with a maximum diameter of 2 cm; and 3) unilateral urinary stones. Exclusion criteria were: 1) prolonged bed rest or severe activity restriction during indwelling stent placement; 2) stone size outside the 0.6–2 cm range; 3) significant preoperative or intraoperative findings affecting stone passage or urinary diversion, especially upper urinary tract malformations or ureteral strictures; and 4) simultaneous surgery on both kidneys and ureters.

All patients underwent standard preoperative laboratory tests, including complete blood count, serum biochemistry, urinalysis, and urine culture. Imaging included noncontrast computed tomography (CT) of the urinary tract or intravenous urography. Patients with renal insufficiency or contrast allergy underwent magnetic resonance urography. Perioperative antibiotic prophylaxis with second-generation cephalosporins was administered intravenously to patients with sterile urine cultures. For those with positive cultures, surgery was postponed until 1) a negative repeat urine culture or urinary nitrite test, and 2) a significant reduction in urinary white blood cell count.

All surgeries were performed under general anesthesia by senior surgeons with over 10 years of experience in urinary calculi management. Two lithotripsy methods were used:

1. URS: A 6/7.5F or 8/9.8F ureteroscope was used to examine the affected ureter. Holmium laser ureterolithotripsy was performed with a 200 μm fiber (Lumenis, Israel) at 0.8–1.0 J energy and 10–30 Hz frequency. A ureteral stent (USI-626-CE-B; Cook, USA; Ultra, Boston Scientific, USA) was left in place. If ureteroscope passage was difficult, a ureteral stent was placed first, and lithotripsy was performed in a second stage after 1 month.
2. F-URS: Initially, the ureteroscope was used to examine the ureter. For cases that could not be completed in one stage, such as failure of the ureteral access sheath to pass a ureteral stent was placed for 2 to 4 weeks for passive dilation. In other cases, a ureteral access sheath (Boston Scientific, USA) was inserted over a super-slide guidewire without radiographic surveillance. A disposable flexible ureteroscope (REDPINE, China) was then advanced to the kidney. Holmium laser lithotripsy was performed using a 200 μm fiber (0.8–1.0 J; 10–30 Hz). Lithotripsy was stopped when single stone fragments were smaller than 2 mm. Stents were then inserted. Residual stones were assessed endoscopically and radiographically.

As this was a retrospective study, stent size selection depended primarily on surgeon preference.

Postoperative imaging included X-ray tomography at 24 h and 30 days to assess double-J stent positioning and detect residual stones. At 30-day follow-up, patients in both groups completed the USSQ.

Data acquisition and processing were conducted independently by the surgical team to ensure objectivity. Discrepancies in interpretation were resolved by consensus between 2 senior urologists. Primary outcomes were SFR at 24 h and 30 days postoperatively, and USSQ domain scores. Secondary outcomes included subquestion scores and complication rates. Gross hematuria was defined as visible blood discoloration of urine (pink, red, brown, or tea-colored). Complications were classified using the Clavien-Dindo system. Cases with incomplete data were excluded.

Statistical analysis

Statistical analysis was performed using SPSS 27.0 (IBM, USA). Continuous variables are expressed as median and interquartile range (IQR) and compared using the Mann-Whitney U test. Categorical variables are expressed as numbers and percentages and compared using the chi-square or Fisher's

exact test. A p-value less than 0.05 was considered statistically significant.

Bioethical standards

The study was conducted according to the Declaration of Helsinki. All patients provided written informed consent before enrollment. The trial was approved by the Ethics Committee of the People's Hospital of Xinjiang Uygur Autonomous Region (number approval: KY2019092506).

RESULTS

A total of 117 patients who met inclusion criteria completed the USSQ one month after surgery. Nine were excluded due to incomplete questionnaire data. The final cohort comprised 108 patients aged 20–77 years, including 82 males (75.9%) and 26 females (24.1%). Treatment modalities included flexible ureteroscopy (F-URS) in 66 patients (61.1%) and ureteroscopy (URS) in 42 (38.9%). The median age was 45 years (IQR 34–54), and median body mass index (BMI) was 26 kg/m^2 (IQR 24–29). Postoperative stratification by indwelling stent diameter showed no significant intergroup differences in age, BMI, stone size, or stone location (Table 1). The 6F group had a slightly higher SFR than the 4.7F group at 24 h (55.1% vs 52.5%) and one month (77.6% vs 74.6%) postoperatively; however, these differences were not statistically significant.

Table 1. *Comparison of general characteristics of the two groups*

Variable	Group 4.7F	Group 6F		p-value
Number of cases	59 (54.6%)	49 (45.4%)		
Sex Male Female	 48 (81.4%) 11 (18.6%)	 34 (69.4%) 15 (30.6%)	χ^2 = 2.098	0.148
Age (years, median) IQR	45 37–54	44 32–53	Z = –0.75	0.453
BMI (kg/m^2, median) IQR	26.3 23.43–28.67	26.07 24.03–28.73	Z = –0.277	0.782
Stone diameter (cm, median) IQR	1.2 0.9–1.5	1.0 0.9–1.5	Z = –0.76	0.447
Sides Left Right side	 37 (62.7%) 22 (37.3%)	 24 (49%) 25 (51%)	χ^2 = 2.054	0.152
Stone location Renal Ureter Multiple	 28 (47.5%) 22 (37.2%) 9 (15.3%)	 27 (55.1%) 20 (40.8%) 2 (4.1%)	χ^2 = 3.611	0.191

BMI – body mass index; IQR – interquartile range

We compared the SFR between groups after URS or F-URS, stratified by surgical method (Table 2). No significant differences were observed in either surgical subgroup.

USSQ domain scores were compared 30 days postoperatively, revealing no significant differences between groups (Table 3). The 4.7F group demonstrated a higher incidence of hematuria than the 6F group (83.1% [49/59] vs 69.4% [34/49]; p = 0.094), though this difference was not statistically significant. Importantly, no significant differences were found in domain-specific index scores for hematuria or other urinary symptoms (Table 4). After stratification by surgical approach, results remained consistent (Table 5).

The incidence of stent-associated pain was comparable between the 4.7F and 6F groups (79.7%

Table 2. *Comparison SFR of two groups*

SFR	Group 4.7F	Group 6F	χ^2	p-value
24-h SFR in all cases Completely clean Residual	52.5% 31 (52.5%) 28 (47.5%)	55.1% 27 (55.1%) 22 (44.9%)	0.071	0.791
24-h SFR in URS* Completely clean Residual	81.8% 18 (81.8%) 4 (18.2%)	95% 19 (95%) 1 (5%)		0.346
24-h SFR in F-URS Completely clean Residual	35.1% 13 (35.1%) 24 (64.9%)	27.6% 8 (27.6%) 21 (72.4%)	0.427	0.513
30-day SFR in all cases Completely clean Residual	74.6% 44 (74.6%) 15 (25.4%)	77.6% 38 (77.6%) 11 (22.4%)	0.130	0.719
30-day SFR in URS	100%	100%		----
30-day SFR in F-URS Completely clean Residual	59.5% 22 (59.5%) 15 (40.5%)	62.1% 18 (62.1%) 11 (37.9%)	0.046	0.830

* Fisher χ^2 was used for analysis.
F-URS – flexible ureterorenoscopy; SFR – stone-free rate; URS – ureterorenoscopy

Table 3. *USSQ sections' score in two groups (IQR)*

Variable	Group 4.7F	Group 6F	Z	p-value
Urinary Symptoms Index Score (U1-U11)	29 (25–31)	29 (25–34)	–0.717	0.473
Body Pain Index Score (P4-P9)	12 (10–14)	12.5 (11–15.75)	–0.94	0.347
General Health Index Score (G1-G6)	13 (10–16)	13 (11–16)	–0.378	0.706
Work Performance Index Score (W5-W7)	8 (7–10)	8 (6–9)	–1.797	0.072
Sexual Matters Index Score (S3-S4)	4 (2.75–5.5)	3 (2.75–3.5)	–1.169	0.242
Additional Problems Index Score (A1-A5)	12 (10–13)	12 (10–13.5)	–0.698	0.485

[47/59] vs 73.5% [36/49]; p = 0.448). Similarly, no statistically significant differences were observed in other body pain domain questions, including pain intensity assessed by the Visual Analogue Scale (VAS) (p = 0.277) and analgesic requirement rates (p = 0.838) (Table 4).

More patients in the 4.7F group than the 6F group reported modifying daily activities due to stent-related symptoms during usual work (87.5% vs 66.7%, p = 0.04). No significant differences were observed between groups in the index scores for the remaining 2 items within the work performance domain (Table 4).

In the sexual function domain, 89.8% of patients in the 4.7F stent group and 87.8% in the 6F stent group reported sexual abstinence (p = 0.733). Among these abstinent patients, stent-related factors were cited by 60.4% of the 4.7F cohort vs 47.6% of the 6F cohort (p = 0.215).

Postoperative complication analysis showed that 83 of 108 patients (76.9%) experienced pain after surgery, with only 17 of these (20.5%) requiring analgesic intervention. Twenty-five patients (23.1%) from both groups reported heavy or severe hematuria; however, none required further medical intervention except one patient who underwent bladder irrigation. Low-grade fever requiring antipyretics was documented in 5 patients (4.6%), all classified as Clavien-Dindo grade I complications. One patient (0.9%) developed moderate-to-severe febrile

Table 4. *Some specific questions' score of USSQ in 2 groups*

	Group 4.7F	Group 6F	Z/χ^2	p–value
Urinary Symptoms				
Frequency (U1)	3 (3–4)	3 (3–4)	–0.039	0.969
Nocturia (U2)	2 (2–3)	3 (2–4)	–1.252	0.211
Urgency (U3)	3 (2–4)	3 (2–4)	–0.591	0.554
Urge incontinence (U4)	1 (1–2)	1 (1–2)	–1.174	0.24
Incontinence without urge (U5)	1 (1–1)	1 (1–1)	–0.249	0.804
Incomplete emptying (U6)	2 (2–3)	2 (2–4)	–1.08	0.28
Burning at voiding (U7)	2 (1–3)	2 (1–3)	–0.883	0.378
Frequencyhaematuria (U8)	3 (2–4)	3 (1–3)	–1.236	0.216
Grade of haematuria (U9)	2 (2–2)	2 (1–2)	–0.926	0.354
Grade of symptoms problem (U10)	2 (2–3)	2 (2–3)	–0.19	0.849
Assume the rest of life (U11)	6 (4–6)	6 (5–7)	–1.001	0.317
Body Pain				
Pain during stenting (P1)	47/59 (79.7%)	36/49 (73.5)	0.577	0.448
Severity of pain-VAS score (P3)	3 (2–5)	4 (2–5)	–1.088	0.277
Pain interrupted sleep (P5)	2 (1–2)	2 (1.25–3)	–1.075	0.282
Painkiller required (P8)	1 (1–1)	1 (1–1)	0.129	0.898
Pain interfered the life (P9)	2 (2–3)	2 (2–3.75)	–0.103	0.918
Work Performance				
Worked for short periods (W5)	2 (1.25–3)	2 (1–2)	–1.78	0.075
Worked usual job with some changes (W6)	3 (2–3)	2 (1–3)	–2.232	0.026
Worked times as usual (W7)	4 (3–5)	4 (2.75–5)	–0.225	0.822
Sexual Matters				
No active sex life (S1)	53/59 (89.8%)	43/49 (87.8%)	0.117	0.733
Pain with sexual intercourse (S3)	1.5 (1–3)	1 (1–1.5)	–1.058	0.29
Satisfied with sex life (S4)	2 (1.75–3.25)	2 (1.75–2)	–0.955	0.34

Table 5. *USSQ sections' score in 2 groups after stratification (IQR)*

USSQ sections		Group 4.7F	Group 6F	Z	p-value
Urinary Symptoms Index Score (U1-U11)	URS	27.5 (23.5–33.25)	28 (25–32.5)	–0.076	0.940
	F-URS				
Body Pain Index Score (P4-P9)	URS	11.5 (9–13)	11 (8.75–16)	–0.46	0.646
	F-URS	12 (10–14)	12.5 (11–15.75)	–0.94	0.347
General Health Index Score (G1-G6)	URS	13 (10–16)	12 (10–16)	–0.633	0.527
	F-URS	13 (10–16)	13 (11–16)	–0.378	0.706
Work Performance Index Score (W5-W7)	URS	8 (7–9)	8 (7–8)	–0.681	0.496
	F-URS	8 (7–10)	8 (6–9)	–1.797	0.072
Sexual Matters Index Score (S3-S4)	URS	4 (2.5–4.75)	3 (3–3)	–1.111	0.266
	F-URS	4 (2.75–5.5)	3 (2.75–3.5)	–1.169	0.242
Additional Problems Index Score (A1-A5)	URS	11 (9–12.25)	11.5 (10–13)	–0.395	0.693
	F-URS	12 (10–13)	12 (10–13)	–0.698	0.485
Grade of haematuria (U9)	URS	2 (2–3)	2 (1.25–3)	–0.193	0.847
	F-URS	2 (2–2)	2 (1–2)	–0.926	0.354

F-URS – flexible ureterorenoscopy; URS – ureterorenoscopy ; USSQ – Ureteric Stent Symptom Questionnaire

Table 6. *Complications in the 2 groups*

Complications	Group 4.7F	Group 6F	p-value
Calvien-Dindo I			
Painkiller required	10/47 (21.3%)	7/36 (19.4%)	0.838
Severe blood in urine	14/59 (23.7%)	11/49 (22.4%)	0.875
Mild fever*	4/59 (6.8%)	1/49 (2.0%)	0.267
Clavien-Dindo II			
Fever with UTI*	0	1/49 (2.0%)	0.454

* Fisher χ^2 was used for analysis

urinary tract infection requiring escalated antibiotic therapy, constituting a grade II complication. No statistically significant intergroup differences were observed in complication rates, and no complications exceeded grade II severity (Table 6).

DISCUSSION

Urolithiasis is a global health concern due to its high incidence and five-year recurrence rates [5, 6]. Ureteral stenting following endoscopic lithotripsy is believed to dilate the ureter, facilitate passage of stone fragments, and relieve associated colic. While prior studies have examined the effectiveness of pre-stenting on SFR [7–9], fewer have investigated postoperative stenting, though it is reasonable to assume that dilation effects persist postoperatively. Additionally, previous research on the relationship between stents and symptoms after ureteroscopic lithotripsy, including flexible ureteroscopy (F-URS) [10–14], has yielded contradictory conclusions.

To address these gaps, we conducted this comparative study evaluating clinical outcomes between 4.7F and 6F stents following endoscopic management of 0.6–2 cm upper urinary tract calculi, aiming to inform optimal stent selection. Our key findings include: 1) comparable SFRs with both 4.7F and 6F stents in URS and F-URS ($p > 0.05$); 2) similar USSQ domain index scores across groups; 3) a higher but statistically nonsignificant incidence of hematuria in the 4.7F group and increased activity modification rates in that cohort; 4) high prevalence of pain and sexual abstinence in both groups; and 5) no significant differences in complications and no serious adverse events in either group.

Because residual stones may contribute to new stone formation, removing residual fragments as completely as possible is crucial. The "stone-free status " metric was introduced to evaluate lithotripsy efficacy. Lumma et al. [15] defined it as "achieved when endoscopically or radiographically visible fragments are completely removed". However, applying this standard clinically is challenging, particularly in F-URS cases using dusting techniques. The necessity of absolute stone clearance in dusting-mode laser lithotripsy remains debated, considering trade-offs between procedural time, tissue trauma, and modest SFR gains. Previous literature [16] presents varying definitions of stone-free status; we adopted the commonly accepted criterion defining residual fragments smaller than 2 mm as stone-free. Optimal imaging for postoperative SFR assessment remains controversial. Kim et al. [17] compared kidney-ureter-bladder (KUB) radiography, ultrasonography, and non-contrast computed tomography (NCCT), finding significantly lower SFR estimates with NCCT ($p < 0.05$). While NCCT offers superior resolution and accuracy, its clinical use is limited by radiation exposure and cost concerns.

Our institution employs X-ray tomography, a high-resolution modality with accuracy superior to KUB radiography and radiation exposure lower than CT. The SFR observed in our study aligns with Kim et al.'s data [17], which reported lower SFRs than earlier studies. To reduce bias, all procedures were performed exclusively by senior endourologists with over 10 years' experience following standardized protocols.

Enlarged space between the stent and ureteral mucosa is considered a key factor enabling stone fragments to pass through the ureter. Robert et al. [18] demonstrated that triangular stents provide 70% more space than conventional stents of the same size with a central lumen. Zeng et al. [19] showed that a 7F triangular stent achieved a higher SFR than a conventional double-J stent. Does this phenomenon also occur with conventional stents? A recent study [20] reported that ureteral wall thickness (UWT) can predict spontaneous passage (SP) of stones, with the non-SP group exhibiting higher UWT. In our study, SFRs were similar between groups at both 24 h and 30 days; however, the 6F group consistently demonstrated a higher SFR than the smaller stent group. Does a larger diameter stent create more space between itself and the ureter or reduce UWT, facilitating stone passage? Furthermore, 6F stents are typically used in ureters that appear more spacious, allow smooth ureteroscope passage, or have been dilated by pre-stenting in our experience. These observations suggest that the mechanisms by which stent diameter modulates ureteral wall and luminal space to guide stone passage require further investigation.

In an observational study by Bosio et al. [10], stent indwelling resulted in 90.1% nocturia, 86.6% urgency, 82.3% burning, and 83.2% pain in patients. In our study, 87% of patients experienced nocturia, 90.7% urgency, 67.6% burning on voiding, and 76.9% reported pain. Additionally, 76.9% reported hematuria, 30.6% urge incontinence, and 15.7% incontinence without urge. The mechanisms underlying ureteral stent-related symptoms remain unclear, but some studies suggest ureteral spasm, urine reflux through the stent, or bladder trigone irritation as contributing factors. Wu et al. [11] concluded that smaller diameter stents have less stiffness, which may reduce ureteral lumen pressure and reflux. Nestler's research [12] found that smaller stents improved scores, with significant differences

in "urinary symptoms" and "work performance." A meta-analysis showed that smaller-diameter stents are associated with reduced urinary symptoms and patient-reported pain [13].

Our results showed no statistically significant differences in urinary symptom index scores between stent sizes, consistent with previous studies [14, 21]. However, more patients in the 4.7F group reported hematuria than in the 6F group. We hypothesize that smaller stents are easier to use in patients with narrower ureters, and a smaller ureteral lumen may increase postoperative bleeding.

In the body pain domain, no significant difference was observed between the 4.7F and 6F groups in our study, consistent with Nestler's report [12]. In contrast, Ehsanullah et al. [13] reported that larger-diameter stents were associated with increased pain, while a meta-analysis of 3 studies found no significant difference in VAS scores with larger stents [22]. Although none of these comparisons reached statistical significance, the smaller-diameter stent group exhibited a higher rate of pain during stenting, and more patients required analgesics than in the larger-diameter group (21.3% vs 19.4%). As noted previously, smaller-diameter stents are easier to deploy in ureters with anatomically narrower lumens, potentially generating increased frictional forces against the ureteral wall or endoscopic devices, which may exacerbate pain perception. Conversely, more patients in the larger-diameter stent group reported sleep interrupted by pain (75% vs 66%), though this difference was also not statistically significant. These seemingly contradictory findings suggest that stent-related body pain arises from multifactorial causes influenced by patient perception; further research is warranted.

In the sexual matters domain, patients with an active sex life had similar index scores between the 2 groups. However, over 80% of patients in both groups reported sexual abstinence, with 60.4% in the 4.7F group and 47.6% in the 6F group attributing this to stenting. Although the difference was not statistically significant, interrupted sexual activity was common among patients with stents. Smaller-diameter stents did not appear to confer an advantage in this respect.

Within the work performance domain, the 4.7F group reported higher scores on the question, "Have you worked at your usual job but with some changes because of the symptoms associated with the stent?". However, no significant differences were observed in other questions, and both groups had similar scores in the General Health and Additional Problems domains.

Although many patients complained of pain during the stenting period, only 10 in the 4.7F group and 7 in the 6F group required analgesic therapy. Fourteen patients in the 4.7F group and 11 patients in the 6F group experienced severe hematuria; however, only one patient in the 6F group had intermittent bleeding during the first 3 days after F-URS surgery that required hospitalization and continuous bladder irrigation. This bleeding was most likely due to accidental injury to submucosal vessels of the renal pelvis. Mild fever was observed in 4 patients in the 4.7F group and one patient in the 6F group, with no significant difference between groups. According to the Clavien-Dindo classification, these were all grade I complications. Grade II complications were documented in one case in the 6F group, manifesting as febrile urinary tract infections (temperature ≥38.5°C) requiring intravenous administration of culture-directed antibiotics. No severe adverse events such as migration, perforation, or septicemia were observed in this study.

Our study has some limitations. First, the inherent bias of the retrospective design limits the validity of our results. Although pre-stenting rates were comparable between groups (22.4 % vs 16.7%, $p = 0.46$), the sample size was insufficient for further stratification. Consequently, the potential impact of factors such as pre-stenting or access sheath use on symptom scores remains unclear. Second, the lack of baseline USSQ assessments limits our ability to distinguish stent-related symptoms from pre-existing lower urinary tract dysfunction. Third, stent size selection in this study was based on single-center experience; thus, a multicenter study evaluating different stent sizes would provide more generalizable evidence.

CONCLUSIONS

Stents of different diameters demonstrated comparable efficacy and safety in the endoscopic management of 0.6–2 cm upper urinary tract stones. Surgical decisions should be individualized based on patient-specific anatomical and clinical factors. However, further prospective studies are warranted to validate the potential benefits of smaller-diameter stents in enhancing patient comfort and improving SFR.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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ETHICS APPROVAL STATEMENT

The study was approved by the Ethics Committee of the People's Hospital of Xinjiang Uygur Autonomous Region (approval number: KY2019092506). All methods were carried out in accordance with relevant guidelines and regulations.

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