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Is pre-stenting necessary for Direct In-Scope Suction (DISS)? Real world practice outcomes from a global prospective multicentre study by EAU Endourology

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Research Article

Keywords: kidney stone disease, FURSL, DISS, suction technology, pre-stenting

Posted Date: September 1st, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10729227/v1

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Additional Declarations: No competing interests reported.

Abstract

Direct in-scope suction (DISS) in flexible ureteroscopy and laser lithotripsy (FURSL) is designed to improve visibility and procedural stone-free rate (SFR). Pre-stenting is commonly used to improve ureteral access sheath placement (UAS) but its role for DISS procedures remains unclear. This study evaluated whether pre-stenting improves peri-operative and post-operative outcomes in patients undergoing FURSL with DISS. This prospective multicentre cohort study analysed patients from the global DISS registry (CRE-2021.684; ClinicalTrials.gov ID: NCT05297331). Patients undergoing FURSL with DISS for renal or proximal ureteric stones between May and December 2025 across 16 centres in 14 countries were included. Patients were grouped according to pre-operative stent status. The primary outcome was 30-day CT-confirmed SFR. Secondary outcomes included operative characteristics, complications, pain, readmission, reintervention, and predictors of SFR and complications. There were 540 patients included, comprising of 356 non-pre-stented and 184 pre-stented patients. UAS use was higher in pre-stented patients (75.5% vs 29.5%, $p < 0.001$) and operative time was longer (60 vs 40 minutes, $p < 0.001$). CT-confirmed Grade A + B SFR was similar between the two groups (90.8% vs 93.8%, $p = 0.491$). Pre-stenting was not independently associated with 100% SFR (OR 1.31, 95% CI 0.80–2.19, $p = 0.291$) or overall complications (OR 1.39, 95% CI 0.82–2.36, $p = 0.220$). Post-operative stent symptoms were more frequent in pre-stented patients (14.7% vs 3.9%). FURSL with DISS achieved high SFRs irrespective of pre-stenting status. Pre-stenting facilitated UAS use but did not independently improve SFR or reduce complications. Routine pre-stenting may not be necessary before DISS.

Introduction

Flexible ureteroscopy and laser lithotripsy (FURSL) is an established treatment option for renal and proximal ureteric stones, particularly when extracorporeal shockwave lithotripsy is not suitable or when endoscopic treatment is preferred. Current guidelines support FURSL in the management of upper tract calculi, with treatment choice influenced by stone size, location, anatomy, comorbidities, and patient preference [1, 2]. Despite advances in single-use digital ureteroscopes, lasers, and ureteral access sheaths (UAS), several challenges remain. These include impaired visibility during dusting, residual fragments, elevated intrarenal pressure, complications, and the need for secondary procedures [3–5]. A recent systematic review suggested that suction technology in ureteroscopy (URS) may improve stone clearance and reduce complications by improving visibility and fragment evacuation [6].

Direct in-scope suction (DISS) is a newer approach in which suction is integrated through the flexible ureteroscope itself rather than relying only on a suction UAS. In vitro work has explored the use of DISS for aspiration of stone dust and fragments, highlighting its potential for clearing dust particles < 250 μm during laser lithotripsy [7]. Early clinical evaluation of the single-use Pusen 7.5 Fr ureteroscope with DISS reported favourable visibility, good suction quality, scope manoeuvrability, low intra-operative and post-operative complication rates, and comparable stone-free rates (SFRs) [8].

Stenting prior to URS remains common but a debated topic. Some advantages include passive ureteric dilatation, easier UAS insertion, reduced ureteric trauma, improved drainage before definitive surgery, and potentially improved stone clearance. A recent systematic review and meta-analysis of randomised controlled trials highlighted that pre-stented patients had improved upper tract access and SFR [9]. However, pre-stenting also carries disadvantages, including pain, lower urinary tract symptoms, infection risk, need for medication, increased healthcare utilisation, and negative impact on patients' quality of life (QoL) [10, 11].

Although existing evidence suggests that pre-stenting may improve operative outcomes in some settings, its role in patients undergoing FURSL with DISS is not clearly defined. Therefore, the aim of this study was to assess whether pre-stenting improves peri-operative and post-operative outcomes in patients undergoing FURSL with DISS. The primary objective was to compare SFR between pre-stented and non-pre-stented patients. Secondary objectives included operative characteristics, complications, pain, readmission, reintervention, renal function, and independent predictors of SFR and complications.

Methods

Study design and baseline characteristics

This was a prospective multicentre cohort study from the global DISS registry. The registry was established by the EAU Section of Endourology research group under an anonymised institutional review board-approved registry at The Chinese University of Hong Kong (CRE-2021.684; ClinicalTrials.gov ID: NCT05297331). Patient recruitment occurred from May to December 2025 across sixteen centres in fourteen countries. Inclusion criteria included patients undergoing FURSL with DISS for renal or proximal ureteric stones. All data were anonymised and managed by the parent institution. Extracted pre-operative data included baseline characteristics, initial presentation, pre-operative stent status and rationale, laterality, stone location, stone size, stone volume, and renal function. Intra-operative data included type of anaesthesia, UAS use, suction UAS use, irrigation device, basket use, suction pressure, laser type, operative time, intra-operative SFR, complications, and post-operative stent use. Post-operative data included complications, length of hospital stay, readmission rate, SFR grade, planned reintervention, stent symptoms, pain score, and renal function.

Intervention

FURSL with DISS was performed using a PUSEN DISS PU3033AH scope (Zhuhai Pusen Medical Technology Co., Ltd., China) under fluoroscopic guidance. Decisions regarding pre-stenting, UAS use, sheath size, laser type, irrigation system, stone treatment strategy, and post-operative stenting were made at the discretion of the operating surgeon according to local practice, available resources, and patient factors. Positive urine cultures were managed according to centre-specific antibiotic guidance.

Antiplatelet and anticoagulant agents were stopped five days before surgery and restarted five days after surgery, where feasible, with any deviations documented.

Stone assessment

All patients underwent pre-operative non-contrast computed tomography (NCCT) within 30 days of surgery and post-operative NCCT at 30 days with 2 mm cuts to assess residual fragments and stone characteristics. Stone volume was calculated using the ellipsoid formula or proprietary CT software where available. Patients with ureteric injury or ureteric stones underwent further follow-up with contrast CT.

Primary outcome

The primary outcome was SFR. SFR was classified on the post-operative NCCT scan following established reporting conventions:

- Grade A: 100% stone-free, zero residual fragment (ZRF)
- Grade B: single residual fragment (RF) ≤ 2 mm in maximum diameter
- Grade C: single RF 2.1-4 mm in maximum diameter
- Grade D: single or multiple RF > 4 mm in maximum diameter

Grade A and Grade B patients were considered stone-free and did not undergo further follow-up or intervention.

Secondary outcomes

Operative time was defined as time from cystoscopy to the end of the procedure. URS time was defined as duration of flexible scope use until removal. Lasering time was recorded from the laser system where available. Intra-operative and post-operative complications were recorded, along with 30-day readmission rates and reinterventions for residual fragments. Ureteric injuries were documented using the Traxer classification [12]. Fever, pain, and sepsis were assessed within 24 hours from operation. Sepsis was defined according to the Third International Consensus for Sepsis and Septic Shock (Sepsis-3) [13]. Loin pain was scored with a standard 10-point visual analogue scale (VAS) on day 1 post-procedure, with 1 indicating the lowest pain score and 10 the highest. Device performance was assessed using a 5-point Likert scale after each case, with 1 indicating excellent and 5 indicating difficult.

Statistical analysis

Statistical analyses were performed using R statistical software, version 4.4.2 (R Foundation for Statistical Computing, Vienna, Austria). A p-value < 0.05 was considered statistically significant. Continuous variables were summarised as median and interquartile range. Categorical variables were summarised as absolute numbers and percentages. Comparisons between pre-stented and non-pre-stented patients were performed using the Mann–Whitney U test for continuous variables and χ^2 or Fisher's exact test for categorical variables.

Multivariable logistic regression was used to evaluate factors associated with 100% SFR and overall complications. Variables included in the models were pre-stenting status, UAS use, stone location, and stone volume. Results were reported as odds ratios (OR), 95% confidence intervals (CI), and p-values.

Results

Baseline characteristics

A total of 540 patients were included, comprising 356 non-pre-stented patients (Group 1) and 184 pre-stented patients (Group 2) undergoing FURSL with DISS. Median age was 55 years in both groups, and the proportion of male patients was similar (55.9% vs 57.9%, p=0.721). ASA grade distribution, diabetes mellitus, renal anatomy, and baseline eGFR were also similar between groups (Table 1). There were several clinically important differences between groups. Hypertension and ischaemic heart disease were more common in the non-pre-stented cohort (51.3% vs 37.7%, p=0.004 and 16.6% vs 8.7%, p=0.018, respectively). Positive pre-operative urine culture was more common in pre-stented patients (28.3% vs 11.5%, p<0.001). Conversely, documented pre-operative antibiotic use was more common in non-pre-stented patients (91.6% vs 78.8%, p<0.001).

Among pre-stented patients, the indication for stenting was emergency decompression in 101 patients (55.8%), elective staged treatment or surgeon preference in 71 patients (39.2%), previous failed access in 9 patients (4.9%) and unspecified or missing reasons in 3 cases (1.6%). Initial presentation differed significantly between groups. Pre-stented patients presented more frequently with pain, fever, or pain and fever, whereas non-pre-stented patients more commonly presented with haematuria or incidental stones (p<0.001).

Stone location also differed significantly. Pre-stented patients had higher proportions of proximal ureteric stones, multiple renal stones, and combined renal and ureteric stones (p<0.001). Renal stone burden was higher in the pre-stented group. Median largest renal stone diameter was 12.0 mm vs 11.0 mm (p=0.040), and median renal stone volume was 650 mm^3 vs 590 mm^3 (p=0.019). Largest overall stone diameter and total stone volume were not statistically significant between groups.

Table 1: Baseline characteristics

Continuous variables given as median [interquartile range] and categorical variables given as absolute number (percentage).

(ASA = American Society of Anesthesiologists Physical Status Classification, DM = diabetes mellitus, eGFR = estimated glomerular filtration rate, HTN = hypertension, IHD = ischaemic heart disease, PUJ = pelvi-ureteric junction)

	Non-pre-stented Group 1 (n=356)	**Pre-stented Group 2** (n=184)	**p-value**
Age	55 [44, 66]	55 [44, 63]	0.499
Male sex	199 (55.9)	106 (57.9)	0.721
ASA			0.731
1	115 (32.4)	67 (36.4)	
2	187 (52.5)	89 (48.3)	
3	50 (14.1)	27 (14.8)	
4	4 (1.1)	1 (0.5)	
DM	75 (21.1)	37 (20.2)	0.894
HTN	182 (51.3)	69 (37.7)	0.004
IHD	59 (16.6)	16 (8.7)	0.018
Positive urine culture	41 (11.5)	52 (28.3)	<0.001
Pre-operative antibiotics	326 (91.6)	145 (78.8)	<0.001
Reason patient was pre-stented			
Failure of initial access	-	9 (4.9)	
Elective staged treatment / surgeon preference	-	71 (38.6)	
Emergency stenting	-	101 (54.9)	
Missing / unspecified		3 (1.6)	
Normal renal anatomy	313 (87.9)	162 (88.0)	1
Laterality			0.014
Left	209 (58.7)	92 (50.0)	
Right	136 (38.2)	77 (41.8)	
Bilateral (same sitting)	11 (3.1)	15 (8.2)	
Initial Presentation			<0.001
Haematuria	74 (20.8)	5 (2.7)	
Pain	96 (27.0)	74 (40.2)	
Fever	6 (1.7)	18 (9.8)	

Incidental	126 (35.4)	52 (28.3)	
Haematuria and pain	48 (13.5)	17 (9.2)	
Pain and fever	6 (1.7)	18 (9.8)	
Stone location			<0.001
Renal upper or interpolar	116 (32.6)	30 (16.5)	
Renal lower pole	79 (22.2)	36 (19.8)	
Renal pelvis (including PUJ)	74 (20.8)	26 (14.3)	
Proximal ureter only	56 (15.7)	40 (22.0)	
Multiple stones, all renal	21 (5.9)	32 (17.6)	
Multiple stones, renal and ureteric	10 (2.8)	18 (9.9)	
Largest stone diameter (kidney), mm	11.0 [8.0, 12.5]	12.0 [8.0, 16.8]	0.04
Stone volume, mm^3 (kidney)	590 [371, 780]	650 [320, 1344]	0.019
Largest stone diameter (ureter), mm	8.5 [7.5, 11.0]	8.0 [6.0, 12.0]	0.317
Stone volume, mm^3 (ureter)	481 [116, 801]	220 [109, 587]	0.089
Largest stone diameter (all), mm	10.0 [8.0, 12.4]	12.0 [7.9, 15.5]	0.066
Stone volume, mm^3 (all)	580 [357, 785]	600 [244, 1237]	0.205
Baseline eGFR, ml/min/1.73m²	76 [66, 85]	80 [65, 90]	0.094

Operative characteristics

General anaesthesia was used less frequently in pre-stented patients (82.1% vs 97.8%, p<0.001), while UAS use was more common in pre-stented patients (75.5% vs 29.5%, p<0.001) (Table 2). The median total operative time was longer in pre-stented patients (60 vs 40 minutes, p<0.001). Median URS time was also longer in the pre-stented group (45 vs 36 minutes, p=0.047).

Type of laser used differed significantly between groups. High-power Holmium with MOSES technology was used more often in pre-stented patients (52.7% vs 13.8%), whereas Thulium fibre laser and Cyber Ho Holmium with Magneto were more common in non-pre-stented patients. Irrigation device, fragmentation strategy, suction type, and suction pressure also differed significantly between groups.

Surgical exit strategy differed significantly. Although stent without thread was the most common in both groups, stent with thread was more common in pre-stented patients (35.9% vs 14.0%), whereas overnight ureteric catheter and totally tubeless strategies were more common in non-pre-stented patients (17.4% vs 3.8% and 7.9% vs 3.3%, respectively).

Table 2: Operative characteristics

Continuous variables given as median [interquartile range] and categorical variables given as absolute number (percentage)

(FANS = flexible and navigable suction access sheath)

	Non-pre-stented Group 1 (n=356)	Pre-stented Group 2 (n=184)	p-value
General anaesthesia	348 (97.8)	151 (82.1)	<0.001
UAS used	105 (29.5)	139 (75.5)	<0.001
Suction UAS (FANS) used	54 (43.5)	80 (56.3)	0.05
Total operation time	40 [33, 57]	60 [40, 79]	<0.001
URS time	36 [24, 59]	45 [30, 60]	0.047
Laser			<0.001
Low-power Holmium (Dornier £30 W)	7 (2.0)	3 (1.6)	
High-power Holmium with MOSES (Lumenis ³100 W)	49 (13.8)	97 (52.7)	
Thulium fibre laser (TFL) (Quanta Fibre dust and IPG <60 W)	151 (42.4)	47 (25.5)	
Pulsed Thulium-YAG (Thulio, Dornier)	11 (3.1)	17 (9.2)	
Cyber Ho Magneto (100 W) (Quanta)	138 (38.8)	20 (10.9)	
Irrigation device type			<0.001
Endomat (Karl Storz, Germany)	48 (13.5)	14 (7.6)	
Endoflow (Rocamed, Monaco	50 (14.0)	94 (51.1)	
Gravity, 3L bag	63 (17.7)	40 (21.7)	
Gravity, 1L bag	169 (47.5)	16 (8.7)	
IRP monitoring SIPS machine (iMIMERsys, ZSR, China)	26 (7.3)	20 (10.9)	
Basket used (relocation and/or fragment extraction)	34 (10.5)	19 (13.0)	0.528
Primary stone fragmentation modality			<0.001
Dusting	245 (63.7)	75 (40.8)	
Combination (popcorning)	121 (34.3)	109 (59.2)	
Suction type			<0.001
Wall-mounted	183 (51.4)	56 (30.4)	
Floor-mounted	125 (35.1)	45 (24.5)	
Automated pressure suction	22 (6.2)	44 (23.9)	

Others/not specified	26 (7.3)	39 (21.2)	
Suction pressure (maximum), mmHg	150 [100, 200]	100 [100, 150]	<0.001
Exit strategy			<0.001
Stent, no thread	216 (60.7)	105 (57.1)	
Stent, with thread	50 (14.0)	66 (35.9)	
Overnight open-ended ureteric catheter	62 (17.4)	7 (3.8)	
Totally tubeless	28 (7.9)	6 (3.3)	

Device performance and assessment

Device assessment was favoured in the pre-stented group for ease of use, with a median Likert score of 1.0 vs 2.0, p<0.001 (Table 3). Visibility and manipulation scores were similar between groups. Scope channel blockage requiring flushing was also similar between groups (7.9% vs 10.7%, p=0.410). Scope malfunction requiring change was more common in the pre-stented group (6.0% vs 0.6%, p<0.001), while scope damage requiring replacement occurred only in the pre-stented group (6.0%).

Table 3: Device performance and assessment

Continuous variables given as median [interquartile range] and categorical variables given as absolute number (percentage).

	Non-pre-stented Group 1 (n=356)	**Pre-stented Group 2** (n=184)	**p-value**
Scope channel blockage needing flushing of channel	36 (10.7)	13 (7.9)	0.41
Scope malfunction requiring change	2 (0.6)	11 (6.0)	<0.001
Scope damage (tip or shaft)			<0.001
None	333 (93.5)	170 (92.4)	
Damaged, requires replacement	0	11 (6.0)	
Likert scale ratings (1-5*)			
Ease of use	2.0 [2.0, 2.0]	1.0 [1.0, 2.0]	<0.001
Visibility	2.0 [2.0, 3.0]	2.0 [2.0, 3.0]	0.494
Manipulation	1.0 [1.0, 2.0]	1.0 [1.0, 1.0]	0.144

*1 = excellent, 2 = very good, 3 = good, 4 = average, 5 = difficult

Intra-operative and post-operative complications

Intra-operative mild bleeding occurred in 7.6% of pre-stented and 10.1% of non-pre-stented patients (p=0.427) (Table 4). Ureteric injury occurred in 4.3% of the pre-stented patients and 1.7% of the non-pre-stented group (p=0.119). All ureteric injuries were Traxer Grade 1 and were managed by post-operative stent placement.

Fever within 24 hours was numerically more frequent in the pre-stented group but was not statistically significant (9.8% vs 5.1%, p=0.057). Zero post-operative sepsis requiring intensive care unit (ICU) admission occurred. Pain scores were lower in pre-stented patients with a median VAS score of 1.0 vs 2.0 (p<0.001). The median hospital length of stay was 1 day in both groups.

All-cause 30-day readmission rate was similar between pre-stented and non-pre-stented groups (4.9% vs 3.1%, p=0.418). However, 30-day complications differed significantly. Stent symptoms were more common in pre-stented patients (14.7% vs 3.9%), whereas loin pain and low-grade fever were more common in non-pre-stented patients (6.2% vs 4.9% and 2.8% vs 0.5%, respectively). Sepsis requiring admission and antibiotics, but not ICU admission, occurred in 1.6% of pre-stented patients and 2.0% of non-pre-stented patients. Overall complications were more common in pre-stented patients (37.6% vs 20.3%, p<0.001).

Table 4. Intra-operative and post-operative complications.

Continuous variables given as median [interquartile range] and categorical variables given as absolute number (percentage).

(AVM = arteriovenous malformation, CD = Clavien Dindo classification, ICU = intensive care unit, PCS = pelvicalyceal system, PUJ = pelvi-ureteric junction, UTI = urinary tract infection, VAS = visual analogue scale)

	Non-pre-stented Group 1 (n=356)	Pre-stented Group 2 (n=184)	p-value
All complications	59 (20.3)	65 (37.6)	<0.001
Intra-operative mild bleeding (obscuring vision but able to continue)	36 (10.1)	14 (7.6)	0.427
Case abandoned	0	1 (0.5)	0.737
Post-operative transfusion (CD 2)	0	0	NA
AVM requiring embolization (CD 3)	0	0	NA
Ureteric injury (all Traxer Grade 1)	6 (1.7)	8 (4.3)	0.119
PUJ	1 (16.7)	1 (12.5)	
Proximal ureter	2 (33.3)	2 (25.0)	
Mid ureter	2 (33.3)	5 (62.5)	
Distal ureter	1 (16.7)	0	
Post-operative fever >38^{O}C (in first 24 hours) (CD1)	18 (5.1)	18 (9.8)	0.057
Post-operative sepsis needing ICU (CD 4)	0	0	NA
Pain score (VAS 1-10, 1 being lowest)	2.0 [1.0, 3.0]	1.0 [0.0, 2.0]	<0.001
Hospital length of stay (days)	1.0 [0.0, 1.0]	1.0 [1.0, 1.0]	<0.001
Readmission within 30 days (any cause)	11 (3.1)	9 (4.9)	0.418
Complications within 30 days			<0.001
None	300 (84.3)	143 (77.7)	
Loin pain (managed with outpatient medication)	22 (6.2)	9 (4.9)	
Low grade fever (managed with outpatient antibiotics)	10 (2.8)	1 (0.5)	
Sepsis (needing admission and antibiotics but no ICU)	7 (2.0)	3 (1.6)	
Stent symptoms	14 (3.9)	27 (14.7)	
New-onset UTI (needing antibiotics)	3 (0.8)	1 (0.5)	
3-month imaging outcomes for ureteric injuries or ureteric stones (CT urogram)			

Hydroureteronephrosis (new onset needing further evaluation)	3 (0.9)	0	0.563
Change in eGFR, ml/min/1.73m²			
Immediate post-operative – baseline	1.0 [-3.0, 5.0]	-2.0 [-12.0, 3.0]	<0.001
3 months – baseline	0.0 [-3.0, 4.0]	-3.0 [-13.0, 0.5]	0.001

Stone-free outcomes

The ZRF rate was 71.3% in Group 1 and 71.7% in Group 2. Overall SFR, Grade A+B, was 93.8% in non-pre-stented patients and 90.8% in pre-stented patients (p=0.491). Grade B RFs were present in 22.5% in Group 1 and 19.0% in Group 2. Surgeon-reported intra-operative 100% SFR was higher in Group 2 patients (60.3% vs 38.5%, p<0.001) (Table 5). Planned reintervention for Grade C+D RF was required in 23.5% of pre-stented patients and 36.4% of non-pre-stented patients (p=0.533).

Table 5: Intra-operative and post-operative stone-free rate.

Categorical variables given as absolute number (percentage).

(RF = residual fragment, SFR = stone-free rate)

	Non-pre-stented Group 1 (n=356)	**Pre-stented Group 2** (n=184)	**p-value**
Intra-operative 100% SFR as reported by surgeon	137 (38.5)	111 (60.3)	<0.001
RF grade, 30-day NCCT in bone window			0.491
A	254 (71.3)	132 (71.7)	
B	80 (22.5)	35 (19.0)	
C	13 (3.7)	9 (4.9)	
D	9 (2.5)	8 (4.4)	
Planned reintervention for RF grade C/D	8 (36.4)	4 (23.5)	0.533

Multivariable analysis

Multivariable logistic regression showed that stone volume was the only significant predictor, with larger volumes were associated with lower odds of achieving 100% SFR after DISS (OR 0.63, 95% CI 0.46-0.85, p=0.003). Neither pre-stenting (OR 1.31, 95% CI 0.80-2.19, p=0.291) nor UAS use (OR 0.84, 95% CI 0.53-

1.33, p=0.459) was independently associated with 100% SFR on 30-day NCCT (Table 6). Compared with renal-only stones, stone location was also not an independent predictor of 100% SFR.

In the model for overall complications, pre-stenting was not an independent predictor (OR 1.39, 95% CI 0.82-2.36, p=0.220) (Table 7). Stone location and stone volume were also not significant predictors. In contrast, UAS use was independently associated with increased odds of overall complications (OR 3.04, 95% CI 1.80-5.19, p<0.001).

Table 6: Multivariable analysis for 100% SFR on 30-day NCCT.

Predictors	OR	95% CI	p-value
Pre-stenting vs non-pre-stented	1.31	0.80 – 2.19	0.291
UAS use	0.84	0.53 – 1.33	0.459
Stone location (vs renal only)			
Ureter	0.66	0.39 – 1.14	0.129
Renal and ureter	1.09	0.42 – 3.21	0.866
Stone volume, cm^3	0.63	0.46 – 0.85	0.003

Table 7: Multivariable analysis for all complications.

Predictors	OR	95% CI	p-value
Pre-stenting	1.39	0.82 – 2.36	0.22
UAS use	3.04	1.80 – 5.19	<0.001
Stone location (vs renal only)			
Ureter	0.9	0.47 – 1.64	0.73
Renal and ureter	2.16	0.84 – 5.61	0.109
Stone volume, cm^3	1.3	0.94 – 1.81	0.116

Discussion

Stenting prior to URS remains an area of ongoing debate. The proposed benefits include passive ureteric dilatation, improved access to the upper tract, easier placement of a UAS, reduced access failure, and potentially higher SFRs [9, 14–17]. A recent systematic review and meta-analysis reported that pre-operative ureteric dilatation strategies, including pre-stenting and medical therapy, were associated with reduced access failure, shorter operative time, higher SFRs, and fewer complications [9]. In past series, DISS has often been performed with a UAS, and pre-stenting may have been used to facilitate a UAS

placement. However, pre-stenting has not been specifically investigated as a requirement for DISS itself [8, 18, 19]. Similarly, a review of DISS devices, technologies, and clinical outcomes did not identify clear in-vitro or in-vivo evidence on the use of pre-stenting for DISS [20].

Another advantage of pre-stenting is that it allows for slow passive ureteric dilatation which may improve access to different parts of the kidney, including lower pole, and newer flexible and navigable suction access sheaths (FANS). Thus, it may help improve calyceal stone access and lithotripsy. However, other than this benefit for ease of scope use or peri-operative outcome of using a DISS scope has not been previously reported [9, 21, 22]. In our study, the reasons for pre-stenting are outlined in Table 1, with the majority undergoing pre-stenting for emergency decompression rather than a surgeon preference with an intent to improve DISS outcomes. The significantly higher UAS use in pre-stented patients (Table 2) suggests that pre-stenting may increase surgeon confidence in UAS placement but as peri- and post-operative outcomes are similar between cohorts, pre-stenting did not appear to add further value in patients undergoing FURSL with DISS.

Regarding peri- and post-operative outcomes, the main finding was that pre-stenting did not independently improve 30-day NCCT-confirmed ZRF or SFR and was not independently associated with reduced complications. This suggests that passive dilatation itself may not have any real influence on modality of suction and is consistent with multicentre data from FANS assisted URS and even the GLITZ procedure, where pre-stenting did not significantly improve SFR [21].

Pre-stenting remains vital for emergency decompression for obstructed infected systems, when initial access fails, planned staged surgery, or when patient anatomy makes passive dilatation a necessity. In our data, the absence of a clear overall SFR or reduced complication benefit from pre-stenting before FURSL with DISS suggest that it is not necessary for all patients and should be balanced against stent morbidity, additional procedures, infection risk, and cost [9]. Instead, a stone-burden-selective approach appears reasonable as larger stone burdens may need longer time and necessitate a UAS placement. Thus, surgeons can pre-emptively consider pre-stenting for UAS use when clinically indicated.

Early clinical studies have shown favourable visibility, manoeuvrability, and suction quality, while in vitro studies have demonstrated pressure reduction and active aspiration of stone dust and fragments [7, 8, 22, 23]. In the present study, both pre-stented and non-pre-stented patients achieved high 30-day CT-confirmed SFRs. This suggests that the use of DISS technique alone may help maintain visibility and facilitate dust evacuation even when UAS is not used. Importantly, the non-pre-stented group had substantially lower UAS use but still achieved comparable CT-confirmed SFR. This warrants further review but was outside the primary aim of this study.

Device performance is also relevant when considering DISS use without pre-stenting. Whilst pre-stenting did not directly affect the ease or ability to perform DISS and was similar in both cohorts (Table 3), we feel the differences in lasering strategy, namely greater use of popcorning in pre-stented patients rather than dusting alone (Table 2), may have generated more fragments causing a channel blockage needing manoeuvres to unblock by repeated channel flushing or scope withdrawal or basket extraction. This

could explain the exclusive scope damage in pre-stented group needing scope replacement. Although this remains hypothetical, the probability of this as a real problem is well established both in vivo and in vitro studies [7, 19, 24]. Perhaps a double lumen scope or the 5.1 Fr larger working channel scope could be a possible better option if both dust and fragments are to be removed [25–27]. This reiterates that DISS with a single 3.6 Fr working channel may work best when fine dust, as defined by the Tenon definition, is generated, necessitating careful choice of laser and lasing strategy [28–30].

Although pre-stenting was associated with greater UAS use, this did not lead to improved CT-confirmed ZRF or overall SFR. It did highlight that UAS use led to increased odds of complications on multivariable analysis. This finding should be interpreted with caution. UAS placement is often selected for larger stones, longer anticipated procedures, repeated access, and more complex cases. Therefore, the observed association may reflect underlying case complexity rather than direct causation. However, it is possible that UAS use contributes to ureteric mucosal trauma, particularly in tight ureters or where larger sheaths are used. Traxer and Thomas previously demonstrated that ureteral wall injuries can occur during UAS insertion and proposed a classification system for these injuries [12]. In the present cohort, all ureteric injuries were low grade, managed with stent placement for 1–4 weeks, and no severe ureteric injuries, avulsions, or post-operative sepsis requiring ICU were reported. This supports the overall safety of FURSL with DISS, while reinforcing the need for careful UAS selection.

Patients' QoL is another important consideration when deciding whether to pre-stent. Ureteric stents are associated with pain, urinary frequency, urgency, haematuria, sleep disturbance, impact on sexual function, interference with daily activities and work, medication use, emergency attendances, and reduced overall QoL [10, 11]. In this study, pre-stented patients had lower immediate post-operative loin pain scores. However, post-operative stent symptoms were almost four times more frequent in pre-stented patients than in non-pre-stented patients. This is clinically relevant because stent morbidity may increase medication use, healthcare utilisation, and delay return to normal activities.

There were significant differences in the post-operative exit strategy. Although this is likely multifactorial and influenced by operator preference, post-operative stent with thread was significantly higher in the pre-stented group (35.9% vs 14%), whereas an open-ended overnight ureteral catheter use was higher in the non-pre-stented group (17.4% vs 3.8%). The reasons we hypothesise that Group 2 had longer operative times (60 vs 40 min, $p < 0.001$) were due to significantly higher UAS use ($p < 0.001$), a significantly lower proportion of case done under gated respiration ($p < 0.001$), significant differences in lasering strategy, scope damages, and significantly larger renal stone volume ($p = 0.019$). Significant differences in renal and ureteric stones and stone multiplicity in the pre-stented groups would have influenced the decision to insert a stent or ureteral drainage post-operatively as all these factors are known reasons for surgeons to reduce the risk of anticipated fragment-related or procedure-related complications. Interestingly, pre-stenting was not beneficial to improve surgeons' confidence of avoiding a post-operative ureteric stent despite confidence of intra-operative SFR being higher in the pre-stented cohort (Table 5). These reasons for stent placement post ureteroscopy have been reported in recent suction clinical studies and systematic reviews [31, 32]. Similarly, intra-operative SFR did not

corresponding to real time post-operative SFR is an observation that has been reported often in endourology [33]. In a recent study by Rico L et al. they have reported that DISS without the use of a UAS and no pre-operative double-J stent placement is effective and safe when chosen in selected patients [34]. Pre-stenting is not a criterion for this approach, but laser choice, good lasering strategy, and safe surgical technique are all contributing factors. Our study may provide the basis of conducting a more detailed focused randomised controlled trial (RCT) with this primary endpoint to validate findings.

The baseline differences between groups are central to interpreting the findings. Pre-stented patients had higher rates of positive pre-operative urine culture, more proximal ureteric or combined renal and ureteric stones, and greater renal stone volume. The higher number of emergency stenting therefore likely represented a more complex cohort. This could explain the higher unadjusted complication rate in this group as well as surgeons' preferred use of accessories and lithotripsy strategies, reflecting a real-world practice but introducing bias. However, in multivariable analysis pre-stenting was not independently associated with overall complications, which is relevant to day-to-day practice when using DISS.

Stone volume was the only independent predictor of 100% SFR. Larger stone volume increases fragmentation burden, dust load, and the risk of residual fragments, even when suction is used. This reflects why in a survey 64% of urologists agreed that stone volume is a better metric and is now being strongly advocated in guidelines [35–37]. Future studies should evaluate whether FURSL with DISS offers particular benefit in specific stone-volume thresholds or whether combined strategies, such as DISS with suction UAS, are preferable for larger-volume stones.

Strengths and limitations

This study has several strengths. It represents a prospective, multicentre, real-world international cohort and reflects contemporary practice across multiple healthcare systems. Stone-free status was assessed using 30-day NCCT with 2 mm cuts, providing a robust and objective evaluation of residual fragments. The study also captured a broad range of peri-operative and post-operative variables, including UAS use, suction type, fragmentation strategy, device performance, complications, pain scores, readmission, reintervention, and renal function. It is among the first studies to report the impact of DISS across two cohorts on scope damage and device-related problems, an area that remains underreported in the clinical literature.

Several limitations should also be acknowledged. First, this was not a randomised controlled trial, and the decision to pre-stent was based on surgeon preference, emergency presentation, or previous failed access; therefore, selection bias and confounding by indication are unavoidable. Second, the pre-stented and non-pre-stented groups differed in several important baseline characteristics, including initial presentation, positive urine culture, stone location, and renal stone burden, although these differences reflect patterns commonly seen in day-to-day practice. While this study aimed to provide objective and realistic findings, and multivariable analysis aims to reduce confounders, cautious interpretation due to

observational and subjective confounding must be noted. Third, because the study was designed to reflect real-world practice, operative technique and equipment use were intentionally not standardised across centres, and exit strategy therefore varied between groups. In addition, patient-reported QoL measures were not used. Device performance was assessed using Likert-scale, which helps to provide a practical outlook on ease of doing DISS as a procedure, but may introduce observer bias. Finally, longer-term follow-up to 1 year would be beneficial to evaluate the incidence of ureteric strictures and the need for further procedures.

Conclusion

Findings suggest that routine pre-stenting before FURSL with DISS may not be necessary. Apart from its association with greater UAS deployment and improved ease of performing DISS scores, it did not independently improve ZRF, overall SFR, reduce overall complications or change the exit strategy on post-operative Double J stent placement. For now, this reflects real-world practice until validated in a dedicated randomised controlled trial.

Declarations

Acknowledgements

None

Conflicts of Interest

V.G. is an educational key opinion leader for PUSEN. The remaining authors declare that they have no competing interests.

Financial support and sponsorship

The authors received no financial support for the research, authorship, or publication of this article.

Author Contribution

Writing, original draft: SND, SKKY, BKS, VG; Data collection: all authors; Data analysis: SND, SKKY, BKS, VG; Review and editing: all authors; Supervision: SKKY, BKS, VG; All authors approved the final manuscript.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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