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Does Ureteral Pre-Stenting Influence Post-Rirs Residual Fragment Rate? A Prospective Analysis

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What's known on the subject? and What does the study add?

Ureteral pre-stenting is commonly used to facilitate access during retrograde intrarenal surgery (RIRS); it is known to increase ureteral compliance and aid ureteral access sheath (UAS) insertion, but its effect on stone clearance remains uncertain. This prospective study confirms that while pre-stenting improves UAS insertion success and reduces operative time, it does not significantly influence residual fragment rates post-RIRS, highlighting the need for selective rather than routine use of pre-stenting.

Abstract

Objective: Retrograde intrarenal surgery (RIRS) is an established treatment modality for renal calculi ≤2 cm. Preoperative ureteral stenting is often employed to facilitate access, but its influence on residual fragment rates remains controversial. This prospective study aimed to evaluate the impact of ureteral pre-stenting on residual stone fragments following RIRS.

Materials and Methods: A prospective observational study was conducted at a tertiary care center from July 2023 to December 2024, involving 180 patients with renal calculi. Participants were randomized into two groups: pre-stented (n=90) and non-stented (n=90). All patients underwent RIRS according to standardized protocols and had a non-contrast computed tomography kidney, ureter, and bladder on postoperative day 90. Residual fragments ≥3 mm were considered significant. Baseline demographics, stone parameters, intraoperative data, and postoperative outcomes were analyzed. Statistical significance was set at $p<0.05$.

Results: Baseline characteristics, including age, body mass index, stone size, volume, and density, were comparable between groups. Ureteric access sheath (UAS) insertion was significantly more successful in the pre-stented group (100%) than in the non-stented group (86.66%, p=0.037). The mean operative time was shorter in the pre-stented group (79.70±18.83 min vs. 89.33±16.02 min, p=0.036). However, the residual fragment rate was identical in both groups (2 patients per group, 6.6%, p=1.000). Postoperative complications, including fever and urinary tract infection, did not differ significantly.

Conclusion: Preoperative ureteral stenting improved the success of UAS insertion and reduced operative time during RIRS but did not influence the rate of residual stone fragments. Pre-stenting may be beneficial in optimizing surgical access, but does not appear to directly enhance stone clearance outcomes.

Keywords: Retrograde intrarenal surgery, ureteral stenting, residual stone fragments, ureteral access sheath, renal calculi

Introduction

The global prevalence of renal stone disease is around 12% (1). According to current guidelines, retrograde intrarenal surgery (RIRS) has become an established standard for the treatment of renal stones up to 2 cm, owing to advances in surgical techniques and instrumentation (2). The introduction of high-resolution flexible ureteroscopes and the development of low-caliber, high-efficiency laser systems have significantly enhanced the safety and efficacy of this approach for managing upper urinary tract calculi. The stone-free rate is one of the primary treatment objectives for renal stone disease. Reported stone free rates for RIRS vary from 54% to 96% for renal stones smaller than 2 cm (3).

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In clinical practice, ureteral double-J (DJ) stents are commonly inserted following RIRS procedures to prevent ureteral obstruction and facilitate postoperative drainage (4). In certain situations, such as obstructive uropathy, active infection, or compromised renal function, stent placement before RIRS is also considered (5). Additionally, pre-stenting may be used to facilitate access in cases where the ureteric orifice is too narrow to accommodate the ureteric access sheath (UAS) (5).

While the guidelines do not mandate routine preoperative stenting for RIRS, emerging evidence suggests that preoperative stenting may influence procedural outcomes (5). Several studies have indicated that pre-stenting can improve intraoperative access, reduce ureteral trauma, and potentially enhance stone clearance (5). However, its impact on residual fragment rates following RIRS remains a subject of debate. This study aims to evaluate the impact of placing a ureteral DJ stent before RIRS on rates of residual stone fragments, with the goal of improving treatment approaches for kidney stones.

Material and Methods

A prospective observational study was conducted at our institute over an 18-month period, from July 2023 to December 2024. A total of 180 patients were enrolled during this period. Ethical and scientific approvals were obtained from the Institutional Ethic Committee of Ruby Hall Clinic (decision no: RHC/BIOPMRFIEC/2022/443, date: 20.07.2023) prior to study initiation. The cohort comprised individuals diagnosed with renal calculi who subsequently underwent RIRS after providing written informed consent to participate in the study. Patients presenting with anatomical variations such as crossed renal ectopia, duplicated collecting systems, or pelvic kidneys were excluded from the study.

Upon presentation to the urology department with a clinical suspicion of nephrolithiasis, patients underwent a comprehensive evaluation, including a detailed medical history and a systemic physical examination. Demographic variables such as age, sex, and body mass index were documented. As part of the preoperative assessment, all patients underwent non-contrast computed tomography kidney, ureter, and bladder (NCCT KUB). Imaging findings were systematically analyzed, including stone characteristics such as size, number, total stone volume, anatomical location, laterality, and radiodensity (measured in Hounsfield units). Following initial evaluation and confirmation of eligibility, all 180 patients were randomly allocated, using a simple randomization technique, into two equal groups: (1) pre-stented and (2) non-stented. A lottery method was employed for simple randomization, i.e., patients were allocated to two groups after randomly drawing their names for stenting or non-stenting to prevent any bias. All patients allocated to the pre-stented group underwent insertion of a 5 Fr/26 cm DJ ureteral stent on the side of the renal stone. RIRS was subsequently performed seven days after stent placement to allow for passive ureteral dilation. In contrast, patients assigned to the non-stented group proceeded directly to RIRS following completion of the preoperative assessment. During RIRS, standard operative procedures were followed, with all intraoperative parameters kept constant, including a 35 Watt thulium fiber laser (IPG Photonics), a 200 µm laser fiber, and a standard UAS sheath (9.5/11.5 Fr). After laser lithotripsy, each calyx was checked for complete dusting of the stone. A DJ stent was placed in all patients after endoscopy, and the stent was removed 3 to 4 weeks postoperatively, when we were certain that the bypass was no longer necessary. All intra-operative and post-operative complications, both major and minor, were considered, along with total operative time. Postoperatively, the stone clearance rate was documented on NCCT KUB on postoperative day 90. Residual fragments ≥3 mm were considered significant.

Data were recorded using a predesigned pro forma and analyzed using Microsoft Excel and IBM SPSS Statistics for Windows, version 25. Descriptive statistics included mean ± standard deviation for quantitative variables and frequencies (percentages) for categorical variables. Normality was assessed using the Shapiro-Wilk test. The chi-square test evaluated associations between qualitative variables, while the Mann-Whitney U test compared quantitative variables. Logistic regression was used for predictive analysis. A p-value of <0.05 was considered statistically significant.

Results

A total of 180 patients were enrolled in the present study and equally allocated to two groups: pre-stented (n=90) and non-stented (n=90). Comprehensive baseline comparisons were conducted to ensure homogeneity between the two cohorts (Table 1).

Discussion

In this prospective analysis, we investigated whether preoperative ureteral stenting influences residual fragment rates following RIRS. Our findings revealed that the number of patients with residual fragments was identical in both the pre-stented and non-stented groups (6 patients in each group), indicating no significant difference in stone-free outcomes. These results suggest that pre-stenting may not play a direct role in improving stone clearance post-RIRS. The stone-related parameters—including number, volume, size, density, and location—were comparable between the two groups, thereby minimizing potential confounding factors. This balanced

Table 1. Impact of pre-stenting on residual fragments post RIRS

Variables	Presented group	Non-stented group	p-values
Patients (n)	90	90	
Age	36.94±7.78	38.04±7.59	0.581
Gender			
Male	48	54	0.602
Female	42	36	
BMI	22.98±2.09	23.33±1.51	0.465
Laterality of stone			
Right	36	48	0.301
Left	54	42	
Number of stones	1.67±0.64	1.83±0.41	0.26
Stone volume (mm^3)	945.96±385.51	968.83±214.49	0.78
Stone size (mm)	14.58±3.8	16±2.28	0.096
Stone density (HU)	1046.33±114.1	999.84±178.62	0.235
Stone location			
lower pole	42	51	0.44
non lower pole	48	39	
UAS insetion successful, n (%)	90 (100%)	78 (86.66%)	0.037
Intraoperative complication			0.313
Intra op. bleeding	0	3	
Post-operative complication			
Post op fever	3	3	>0.999
Post op UTI	6	3	0.554
Surgical duration (min)	79.70±18.83	89.33±16.02	0.036
Number of patients with residual fragments	6	6	>0.999

BMI: Body mass index, HU: Hounsfield unit, UAS: Ureteral access sheath, UTI: Urinary tract infection, min: Minimum, RIRS: Retrograde intrarenal surgery

distribution supports the reliability of comparing residual fragment outcomes between groups. While some researchers, such as Rubenstein et al. (6), have reported a significant association between stent placement and improved stone-free rates, others have found no such correlation. For instance, Fabrizio et al. (7) observed that although pre-stenting facilitated ureteral dilation and improved access during surgery, it did not significantly influence the final stone clearance outcomes.

In our study, we observed a significantly higher success rate of UAS insertion in patients who underwent preoperative DJ stenting; i.e., all 90 (100%) patients in the prestented group had successful UAS insertion, compared with 78 patients (86.6%) who did not undergo prestenting. The use of a UAS has become integral to RIRS, offering advantages such as reducing intrarenal pressure, improving endoscopic visibility, preventing pyelovenous reflux, and facilitating multiple re-entries into the collecting system during the procedure. However, UAS placement is not universally successful and may be limited by anatomical constraints such as narrow ureters or tight ureteral orifices. The native ureter typically measures 6-9 Fr in diameter, whereas commonly used UASs have outer diameters ranging from 9.5 to 11.5 Fr, often exceeding the ureter's natural caliber and posing a challenge for direct insertion. The successful insertion of UAS in the pre-stented group is attributed to passive ureteral dilation induced by the indwelling stent; this dilation increases ureteral compliance, straightens ureteral kinks, and enlarges the ureteral orifice, thereby facilitating smoother insertion of larger-caliber sheaths. Mogilevkin et al. (8) prospectively evaluated the ability to insert a 14 Fr UAS and analyzed possible predictors of successful insertion. The failure rate for UAS placement was approximately 15%, and pre-stenting appeared to be a positive predictor of UAS placement in his study. Perlmutter et al. (9) observed that preoperative ureteral stenting contributed to passive dilation of the ureter, which in turn influenced the procedural outcomes of RIRS.

Moreover, the duration of surgery was significantly shorter in the pre-stented group than in the non-stented group. This suggests that, although pre-stenting may not directly improve stone-free rates, it can enhance procedural efficiency, possibly by facilitating navigation within the urinary tract.

In our prospective study, we also evaluated the influence of preoperative ureteral stenting on intraoperative and postoperative complications of RIRS. The results indicated no statistically significant difference in complication rates between the pre-stented and non-stented groups. These results are consistent with previous literature, indicating that while ureteral stents can facilitate access during RIRS, they do not appear to markedly reduce complication rates. Prolonged stent dwell time is sometimes associated with increased irritative symptoms and an increased risk of infection. However, in our study, where stenting was applied selectively and in a controlled manner, no such increase in postoperative morbidity was observed.

In our study, although pre-stenting conferred procedural advantages—higher UAS insertion success rate and shorter operative time—there was no significant difference in the residual fragment rate between the pre-stented and non-stented groups. This supports the notion that while preoperative stenting may optimize surgical conditions, its impact on overall stone clearance remains limited. These contrasting findings in the literature highlight the need for a more individualized approach, where the decision to pre-stent is based on patient anatomy, stone complexity, and anticipated technical challenges rather than a routine protocol.

Our study offers several strengths. It is a prospective observational study assessing the impact of preoperative ureteral stenting on residual fragment rates and perioperative outcomes following RIRS. All patients were evaluated using NCCT KUB, which remains the gold standard for stone assessment and ensures high diagnostic accuracy. Imaging was interpreted by a senior radiologist who was blinded to surgical outcomes and who employed standardized techniques, including magnification and bone-window settings, to minimize bias. To maintain procedural consistency, all surgeries were performed by experienced endourologists using the same model of flexible ureteroscope and identical disposable instruments.

Study Limitations

Our findings, from a study conducted at a high-volume tertiary care center with uniform surgical protocols and imaging quality, reflect outcomes under optimized clinical conditions. However, external validation across centers with different levels of expertise, equipment availability, and procedural variation is essential to establish the broader relevance of the results.

Conclusion

This prospective study demonstrated that preoperative ureteral stenting significantly improved the success rate of UAS placement and reduced operative time during RIRS. However, pre-stenting did not significantly affect the incidence of residual stone fragments or of intraoperative or postoperative complications.

Ethics

Ethics Committee Approval: Ethical and scientific approvals were obtained from the Institutional Ethic Committee of Ruby Hall Clinic (decision no: RHC/BIOPMRFIEC/2022/443, date: 20.07.2023) prior to study initiation.

Informed Consent: The cohort comprised individuals diagnosed with renal calculi who subsequently underwent RIRS after providing written informed consent to participate in the study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: K.J., K.R., R.C., Concept: K.J., K.R., R.C., Design: K.J., K.R., R.C., Data Collection or Processing: K.J., K.R., R.C., Analysis or Interpretation: K.J., K.R., R.C., Literature Search: K.J., K.R., R.C., Writing: K.J., K.R., R.C.

Conflict of Interest: No conflict of interest was declared by the authors.

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