Clinical and postoperative characteristics of stentless ureteroscopy patients: a prospective analysis from ReSKU

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Introduction: *To evaluate the clinical characteristics as well as the postoperative course of urolithiasis patients undergoing a ureteroscopy (URS) without stent placement.*

Materials and methods: *This was a prospective case cohort study utilizing data collected in the Registry for Stones of the Kidney and Ureter (ReSKU) from a single institution between October 2015 and December 2020. We identified all consecutive patients undergoing URS for stone disease and analyzed data encompassing demographics, medical history, intra and postoperative characteristics, including complications and postoperative symptoms. Univariate and multivariate logistic regression analyses were performed based on the presence or absence of an indwelling ureteral stent.*

Results: *A total of 470 patients were included for analysis, 92 patients in the stentless group (19.5%). Factors associated with stentless ureteroscopy were a lower stone burden ($p < 0.001$), the pre-existence of a ureteral stent (37.4% vs. 27.9% $p = 0.011$), absence of an access sheath (14.6% vs. 69.5% $p < 0.001$), and a shorter operative time (31 vs. 58 min $p < 0.001$). Postoperative gross hematuria and lower urinary tract symptoms (LUTS) were reported less frequently in stentless patients ($p = 0.02$, $p = 0.01$, respectively). There was no difference in postoperative complications between both groups (15.2% vs. 12.0%, $p = 0.385$). On multivariate analysis, the risk of postoperative complications was associated with obesity, stone burden ≥ 1 cm, and positive preoperative urine culture. There was no patient who required emergent stent placement in the stentless group.*

Conclusion: *Our data show that, in well selected patients, omitting ureteral stent placement after URS can decrease postoperative gross hematuria and LUTS without increasing postoperative complications.*

Key Words: ureteroscopy, ureteral stent, postoperative complication, postoperative symptom, urolithiasis

Introduction

Ureteroscopy (URS) and laser stone lithotripsy remains one of the most widely performed procedures amongst urologists in the management of kidney stones and its utilization is currently on the rise.[1,2] This is mainly due to a high stone free rate and overall good safety profile.

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Ureteral stents are frequently placed at the time of URS to ensure upper urinary tract drainage and left indwelling for a finite period. The European Association of Urology guidelines stress that stents after URS should be placed "in all doubtful cases, to avoid stressful emergencies",[3] while the American Urological Association guidelines recommend omitting stents unless there is a concern for ureteric injury, stricture, abnormal anatomy, solitary kidney, impaired renal function, or planned subsequent procedure.[4]

Despite these guidelines, studies suggest that ureteral stents are placed after 75%-90%[5,6] of URS lithotripsy procedures in the United States. The concern of postoperative renal colic, infection or unplanned

hospital visits results in urologists placing stents routinely over 60% of the time according to survey results.[7] Due to this tendency to default in favor of ureteral stenting, a significant proportion of these patients may be stented unnecessarily.

In our practice, we try to omit stent placement whenever that is possible, and only offer selective ureteral stenting based on patient's specific clinical and operative characteristics. In this study, we attempt to highlight these characteristics and describe the operative and postoperative course of patients undergoing 'stentless' ureteroscopy in our practice.

Materials and methods

Study design and patient enrollment

This is a single-center, case cohort study based on prospectively collected data from the Registry for stones of the Kidney and Ureter (ReSKU)[8] (Institutional review board; CHR 14-14533), a stone registry that interfaces with the electronic medical record to automatically collect clinical data on urolithiasis patients on an ongoing basis. All subjects enrolled in ReSKU provided a written consent at their initial enrollment. We included all consecutive patients undergoing ureteroscopy for stone disease at our institution between October 2015 and December 2020.

Data collection

We collected data on all patients undergoing URS for kidney stones, including patients' demographics, medical history as well as preoperative characteristics (American Society of Anesthesiologists (ASA) score, pre-existence of a drainage tube, positive preoperative urine culture), operative characteristics (stone location, stone burden, use of access sheath, operative time, and stone clearance) and postoperative characteristics (complications and symptoms).

We excluded all patients younger than 18 years old, those undergoing antegrade URS procedures and URS drained postoperatively by a nephrostomy tube.

Statistical analysis

Univariate analyses were performed based on the presence or absence of an indwelling ureteral stent. Means in both groups were compared using two-sample t tests and Mann-Whitney U test. Categorical variables were compared using Fisher's exact and chi-squared tests.

Finally, a logistic regression was performed on the multivariate analysis to identify predictors of postoperative complications, pain, gross hematuria, LUTS and need for hospitalization.

Statistical significance was defined as a p value < 0.05 and a calculated 95% confidence intervals. All statistical analyses were performed using R Studio Version 1.3 (Boston, MA, USA).

Results

A total of 465 patients were included in this study, 92 patients in the no stent group (19.7%) vs. 373 patients in the stented group (80.3%). Clinical and demographic characteristics were comparable between both groups, except for a higher percentage of male patients in the stented group (56.3% vs. 40.2%, $p = 0.007$, Table 1). When comparing operative data, the stented group had a higher stone burden ($p < 0.001$), more frequent use of ureteral access sheath (69.5% vs 14.6% $p < 0.001$) and a longer operative time (58 vs. 31 min $p < 0.001$). Preoperative drainage differed significantly between

TABLE 1. **Patient's clinical and demographic characteristics**

Characteristics	**No-stent (n = 92)**	**Stent (n = 378)**	**p value**
Age, years, mean (SD)	54.88 (18.60)	56.86 (15.64)	0.295
Gender, male, n (%)	38 (41.3)	210 (55.6)	0.015
BMI, mean (SD)	29.00 (8.37)	28.61 (7.33)	0.661
DM, n (%)	16 (17.4)	46 (12.2)	0.228
ASA score, n (%)			0.674
1	10 (10.9)	46 (12.2)	
2	58 (63.0)	252 (66.8)	
3	24 (26.1)	77 (20.4)	
4	0 (0.0)	2 (0.5)	

BMI = body mass index; DM = diabetes mellitus; ASA = American Society of Anesthesiologists

TABLE 2. **Patient's operative characteristics**

Characteristics	No-stent (n = 92)	Stent (n = 378)	p value
Preoperative existing tube, n (%)			0.011
No tube	49 (53.8)	256 (68.6)	
Ureteral stent	34 (37.4)	104 (27.9)	
Nephrostomy	8 (8.8)	11 (2.9)	
Both	0 (0.0)	2 (0.5)	
Positive preoperative urine culture, n (%)	19 (26.4)	60 (19.9)	0.261
Stone location, n (%)			0.12
Ureter	43 (46.7)	197 (52.4)	
Kidney	43 (46.7)	136 (36.2)	
Both	6 (6.5)	43 (11.4)	
Stone burden, n (%)			< 0.001
< 1 cm	64 (71.9)	153 (43.0)	
1-2 cm	23 (25.8)	151 (42.4)	
> 2 cm	2 (2.2)	52 (14.6)	
Access sheath use, n (%)	11 (13.3)	253 (69.3)	< 0.001
Bilateral procedure, n (%)	16 (17.4)	53 (14.1)	0.415
Operative time, minutes [range]	35.50 [9.00, 136.00]	59.00 [11.00, 218.00]	< 0.001
Stone clearance, n (%)	91 (98.9)	365 (96.5)	0.322

both groups, with a higher percentage of preexisting stents and nephrostomy tubes in the stentless cohorts (37.4% vs. 27.9% and 8.8% vs. 2.9 % respectively, p = 0.011, Table 2). In terms of outcomes, the no stent group had a significant lower rate of postoperative LUTS (1.6% vs. 18.6% p = 0.011) and gross hematuria (2.2% vs. 8.9% p = 0.027) without any difference in stone clearance, postoperative complications, pain, or hospitalization rate, Table 3.

On multivariate analysis, obesity (OR 1.98 p = 0.049), large stone burden (OR 2.25 p = 0.044) and positive preoperative urine culture (OR 2.97 p = 0.005) were identified as risk factors for postoperative complications, Table 4. When it comes to postoperative symptoms, male patients expressed significantly less pain (OR 0.37 p = 0.001) while the presence of a stent increased postoperative LUTS significantly (OR 3.11 p = 0.039, Table 5).

TABLE 3. **Postoperative complications and symptoms**

Variables	No-stent (n = 92)	Stent (n = 378)	p value
Clavien-Dindo ≥ Grade 1, n (%)	14 (15.2)	44 (12.0)	0.385
Postoperative pain, n (%)	18 (19.6)	74 (20.0)	1
Postoperative gross hematuria, n (%)	2 (2.2)	33 (8.9)	0.027
Postoperative LUTS, n (%)	7 (7.6)	69 (18.6)	0.011
Hospitalization, n (%)			0.401
0 days	74 (81.3)	318 (87.4)	
1 day	12 (13.2)	31 (8.5)	
≥ 2 days	5 (5.5)	15 (4.1)	

LUTS = lower urinary tract symptoms

TABLE 4. **Multivariate analysis on predictors of postoperative complications**

Variables	Clavien-Dindo ≥ Grade 1		Hospitalization ≥ 2day	
	Odds ratio (95% CI)	p value	Odds ratio (95% CI)	p value
Age	0.98 (0.96-1.00)	0.091	0.99 (0.96-1.03)	0.71
Body mass index > 30	1.98 (1.00-3.92)	0.049	0.37 (0.04-3.31)	0.38
Male	0.67 (0.33-1.37)	0.28	0.82 (0.24-2.89)	0.76
Stone burden ≥ 1 cm	2.25 (1.02-4.96)	0.044	1.22 (0.31-4.76)	0.78
Positive preoperative urine culture	2.97 (1.37-6.45)	0.0059	7.09 (1.75-28.70)	0.006
Existing tube	0.60 (0.34-1.05)	0.073	1.95 (0.52-7.33)	0.32
Bilateral procedure	1.08 (0.46-2.54)	0.86	1.14 (0.22-5.79)	0.88
Operative time	1.00 (0.99-1.01)	0.7	1.01 (0.99-1.03)	0.48
Access sheath use	0.89 (0.39-2.01)	0.78	1.18 (0.52-2.71)	0.69
Stent placement	0.67 (0.27-1.67)	0.39	0.45 (0.11-1.84)	0.26

TABLE 5. **Multivariate analysis on predictors of postoperative symptoms**

Variables	Postoperative pain		Postoperative gross hematuria		Postoperative LUTS	
	Odds ratio (95% CI)	p value	Odds ratio (95% CI)	p value	Odds ratio (95% CI)	p value
Age	0.99 (0.97-1.00)	0.12	1.02 (0.99-1.05)	0.21	1.00 (0.98-1.02)	0.85
Body mass index >30	1.06 (0.58-1.94)	0.86	0.63 (0.24-1.69)	0.36	0.86 (0.44-1.67)	0.66
Male	0.37 (0.20-0.67)	0.0012	2.07 (0.81-5.30)	0.13	0.60 (0.32-1.12)	0.11
Stone burden ≥ 1 cm	1.39 (0.72-2.66)	0.33	0.73 (0.29-1.84)	0.51	1.73 (0.86-3.49)	0.12
Preoperative urine culture positive	1.85 (0.92-3.70)	0.084	0.84 (0.22-3.25)	0.8	1.96 (0.91-4.21)	0.085
Existing tube	0.66 (0.41-1.06)	0.088	0.73 (0.31-1.71)	0.46	0.62 (0.36-1.06)	0.081
Bilateral procedure	1.65 (0.78-3.46)	0.19	1.00 (0.27-3.78)	1	1.51 (0.67-3.39)	0.32
Operative time	1.00 (0.99-1.01)	0.74	1.00 (0.99-1.02)	0.71	1.00 (0.99-1.01)	0.41
Access sheath use	0.99 (0.50-1.96)	0.97	1.15 (0.44-2.99)	0.77	0.66 (0.32-1.34)	0.24
Stent	1.19 (0.53-2.69)	0.68	5.26 (0.63-43.80)	0.12	3.11 (1.06-9.10)	0.039

LUTS = lower urinary tract symptoms

Discussion

In this study, we aimed to describe the clinical characteristics and outcomes of patient undergoing URS without stent placement in our practice through the ReSKU data. Overall, almost 80% of URS patients underwent a ureteral stent placement. This percentage is within the reported range of urology practices in the United States.[5-7]

Clinical characteristics differed significantly between both groups, Table 1 and 2. The stented group had a higher percentage of male patients, as well as a larger stone burden, a more frequent use of ureteral access sheath and a longer operative time. Stone burden and operative time were also identified as significant predictor factors of postoperative stent placement in the Clinical Research office of Endourological Society (CROES) Ureteroscopy Global Study, along with intraoperative complications, impacted stones, presence of solitary kidney, stone free rate and age.[6] Age was not significantly different between both groups in our study.

Furthermore, our 'stentless' cohort characteristics were also like those reported more recently by Hiller et al in a statewide surgical collaborative assessing the pattern of stent placement and its impact on downstream health service.[9] In this study, pre-stented cases and renal stones had a decreased odds of stent placement. While our 'stentless cohort' had indeed a higher percentage of patients with pre-existing stents, stone location did not differ between both groups.

Patients undergoing 'stentless' URS experienced significantly less postoperative hematuria and LUTS. These results are concordant with the findings of multiple large systematic reviews addressing ureteral stent placement after URS.[8,10] In fact, Tang et al found that patients with an indwelling stent post URS are twice more likely to develop postoperative hematuria and dysuria compared to non-stented patients.[10]

Whether a ureteral stent placement after ureteroscopy reduces healthcare visits is still a matter of debate. While Pais et al found that stent omission increased the odds of an unplanned health care visit by more than 60% in a systematic review, Mittakanti et al found no significant differences in emergency department visits or unplanned admissions within 7 days between patients with or without a ureteral stent after ureteroscopy in a large retrospective analysis based on a state ambulatory surgery database.[5,11] On the other hand, stent placement was associated with a 1.25 higher odds of emergency department visit but not hospitalization in a large retrospective study by Hiller and al.[9] Although our data does not capture postoperative Emergency department visits, we did not find any difference in postoperative hospitalization rate between both groups.

Another question that is not fully answered in the current literature is: does a ureteral stent reduce postoperative complications? While the CROES study reported significant reduction of postoperative complications in patients undergoing postoperative JJ placement, other systematic reviews failed to show difference in postoperative pain, urinary tract infections, urosepsis, or need for secondary intervention after stent omission.[6,8,10] Likewise, there was no difference in complications between both groups in our cohort. None of our patients in the non-stent group required an emergency postoperative stent placement. This seems to be an uncommon event in most reported literature with an incidence of < 1%.[9]

On our multivariate analysis we identified obesity, stone burden, and preoperative positive urine culture as predictors of postoperative complications (defined as Clavien-Dindo grade ≥ 1). The presence of an indwelling ureteral stent did not decrease the odds of developing postoperative complications or hospitalizations. In their recent meta-analysis looking specifically at-risk factors of urosepsis after ureteroscopy, Bhojani et al identified preoperative urine culture and diabetes mellitus, but not BMI or stone Burden, as significant predictor factors for postoperative urosepsis. Postoperative ureteral stent placement, however, was not assessed as a potential risk factor of urosepsis in this study.[12]

The main goal of our study was to describe and understand the characteristics and clinical course and outcomes of patients undergoing a stentless ureteroscopy in our practice. We identified that one out of five URS patients undergo omission of stent placement, and these patients develop significantly less postoperative hematuria and LUTS with similar stone free rate and without any increase in postoperative complications or need for hospitalizations. None of these patients required an emergent stent placement. These findings reflect on the safety of stent omission, in carefully selected patients.

We realize that there are multiple limitations to our findings. First, the sample size of our cohort is smaller than other reviews that addressed the same topic, although it is important to note our data is prospectively collected and comes from a single institution, making it more homogenous than other retrospective reports from pooled data sets or multiple institutions. Second, the criteria for stent omission are not defined and the decision is based on the subjective judgment of the surgeon, this poses a selection bias towards the 'No-stent' group. But as previously mentioned, the goal from this review was to analyze the characteristics and the outcomes of this group, rather than a head-to-head comparison of the indications or outcomes of stent placement after URS. Third, intraoperative complications as well as postoperative emergency department visits were not recorded in our study as they were not captured by our ReSKU registry, so it is difficult for us to draw any conclusion regarding the impact of stent omission on these clinical outcomes.

Future larger studies using more comprehensive definition of 'uncomplicated' URS with clear criteria are needed to clarify this ongoing dogma in our field.

Conclusion

In well selected patients, omitting ureteral stent placement after ureteroscopy can decrease postoperative gross hematuria and LUTS without increasing postoperative complications.

Obesity and higher stone burden, as well as a positive preoperative urine culture, are factors that might increase postoperative complications. □

References

1. Raheem OA, Mirheydar HS, Miller DL, Palazzi KL, Chang DC, Sur RL. Contemporary trends in the ambulatory surgical treatment of urolithiasis: population-based analysis. *J Endourol* 2015;29(10):1189-1192.
2. Strope SA, Wolf JS Jr, Faerber GJ, Roberts WW, Hollenbeck BK. Changing practice locations for upper urinary tract stone disease. *J Urol* 2009;182(3):1005-1011.
3. Turk C, Neisius A, Petrik A et al. EAU guidelines on urolithiasis. EAU 2018. https://uroweb.org/guidelines/urolithiasis.
4. Assimos D, Krambeck A, Miller NL et al . Surgical management of stones: American Urological Association/Endourological Society Guideline, PART I. *J Urol* 2016;196(4):1153-1160.
5. Mittakanti HR, Conti SL, Pao AC et al. Unplanned emergency department visits and hospital admissions following ureteroscopy: do ureteral stents make a difference? *J Urol* 2018;117:44-49.
6. 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.
7. Dauw CA, Simeon L, Alruwaily AF et al. Contemporary practice patterns of flexible ureteroscopy for treating renal stones: results of a worldwide survey. *J Endourol* 2015;29(11):1221-1230.
8. Ordonez M, Hwang EC, Borofsky M, Bakker CJ, Gandhi S, Dahm P. Ureteral stent versus no ureteral stent for ureteroscopy in the management of renal and ureteral calculi. *Cochrane Database Syst Rev* 2019;2(2):CD012703.
9. Hiller SC, Daignault-Newton S, Pimentel H et al. Ureteral stent placement following ureteroscopy increases emergency department visits in a statewide surgical collaborative. *J Urol* 2021;205(6):1710-1717.
10. Tang L, Gao X, Xu B et al. Placement of ureteral stent after uncomplicated ureteroscopy: do we really need it? *Urology* 2011; 78(6):1248-1256.
11. Pais VM, Smith RS, Stedina EA, Rissman CM. Does omission of ureteral stents increase risk of unplanned return visit? A systematic review and meta-analysis. *J Urol* 2016;196(5):1458-1466.
12 Bhojani N, Miller LE, Bhattacharyya S, Cutone B, Chew BH. Risk factors for urosepsis after ureteroscopy for stone disease: A systematic review with meta-analysis. *J Endourol* 2021;35(7): 991-1000.