

Postoperative events and complications of next-day stent removal following uncomplicated percutaneous nephrolithotomy compared to longer stenting

Taylor Goodstein¹, Patrick Mershon¹, Tasha Posid¹, Aliza Khuhro¹, Mary Charleton², Amara Ndumele², Colin Kleinguetl¹, Chase Arnold¹, Bodo Knudsen¹, Michael Sourial¹

¹Department of Urology, Ohio State University Medical Center, Columbus, OH, United States; ²Ohio State University College of Medicine, Columbus, OH, United States

Cite as: Goodstein T, Mershon P, Posid T, et al. Postoperative events and complications of next-day stent removal following uncomplicated percutaneous nephrolithotomy compared to longer stenting. *Can Urol Assoc J* 2023;17(11):E381-7. <http://dx.doi.org/10.5489/cuaj.8364>

Published online August 3, 2023

ABSTRACT

INTRODUCTION: Options for renal drainage after percutaneous nephrolithotomy (PCNL) vary and depend primarily on surgeon preference and case considerations. In our practice, patients traditionally returned one week postoperatively to remove the stents in the office via cystoscopy; however, following uncomplicated PCNL with no plans for second-look procedure, a ureteral stent on a tether is currently removed in tandem with the Foley catheter on postoperative day 1 (POD1) prior to patient discharge. This study compared the number of postoperative events between POD1 stent removal and their longer stented counterparts.

METHODS: We conducted a retrospective chart review on all patients who had undergone PCNL at our institution from January 1, 2020, to June 31, 2021. Patient demographics, operative metrics, and postoperative events (telephone calls, emergency department [ED]/clinic visits, and complications) were recorded and compared between the two groups.

RESULTS: A total of 243 patients were included in final analysis: 46% (n=111) had their stent removed on POD1 and 54% (n=132) had longer indwelling stent times. Baseline demographics were similar between the two groups. Number of telephone calls (p=0.081), ED/clinic visits (p=0.093), and complications (p=0.647) were similar between groups. There were three (1.3%) unplanned second-look procedures: two (1.8%) in the POD1 stent removal group and one (0.8%, p=0.475) in the later stent removal group.

CONCLUSIONS: In this limited, retrospective study, we did not detect a difference in postoperative events or short-term complications for POD1 vs. later stent removal after uncomplicated PCNL.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the gold-standard procedure for managing large or complex uroliths.¹ Options for kidney drainage following PCNL include nephrostomy tubes, ureteral stenting, 5 F ureteral catheters, or a “totally tubeless” approach, and is based primarily on surgeon preference and case considerations.² Studies have demonstrated improved postoperative pain and hospital stay without worse safety outcomes in patients managed with ureteral stents as opposed to nephrostomy tube after PCNL.³⁻⁶ Indwelling stents can be removed via outpatient cystoscopy several days postoperatively;² however outpatient cystoscopy can be inconvenient and stents are often poorly tolerated, with 78% of patients reporting urinary discomfort and over 80% of patients reporting stent-related pain affecting daily activities.^{7,8} Previous studies have examined leaving the tether attached to the stent for easy removal at a later date.^{7,9,10} To our knowledge, no study has examined the optimal duration of indwelling ureteral stent time after PCNL. At our institution, in select patients, the ureteral stent on a tether is often removed in tandem with the Foley catheter on postoperative day 1 (POD1) prior to patient discharge following uncomplicated PCNL. As such, the patient is discharged “total-

ly tubeless," which obviates the need for a return visit for stent removal.

The objective of this study was to determine whether patients who had their stent removed on POD1 after PCNL vs. at a later time presented with more postoperative events (telephone calls, unplanned clinic or emergency department [ED] visits) or complications as a result of earlier stent removal compared to their longer stented counterparts.

METHODS

This was a retrospective chart review performed on patients who underwent PCNL at our institution from January 1, 2020, to June 31, 2021 (IRB #2021H0297). All patients undergoing PCNL were evaluated for inclusion. Exclusion criteria included 1) younger than 18 years; 2) spinal cord injury and/or presence of neurogenic bladder or with reconstructed or altered urogenital anatomy; 3) procedures with incomplete stone clearance with a planned second procedure; 4) patients

with a nephrostomy tube or other tubes for postoperative drainage; and 5) concomitant bilateral procedures or procedures on a solitary kidney. Any of these criteria defined the PCNL procedure as "complicated" and were excluded (Figure 1). Of note, this practice was started at our institution during the COVID-19 pandemic to minimize foot traffic for patients having to come back in person to have stents removed from their procedure. Given that patients fared well, the two surgeons who performed PCNL at our institution adopted this practice more regularly at that time.

The PCNL procedure was performed by one of two surgeons. The decision to plan for POD1 stent removal was made at the discretion of the operating surgeon at the conclusion of each case. For a stent to be removed on POD1, there had to be no unanticipated intraoperative challenges, such as severely impacted stones, collecting system/ureter injury, vital sign instability, excessive bleeding during the procedure, or suspected residual fragments (visually by rigid and flexible nephroscopy, or fluoroscopically). In those instances, a stent would usually be left for a longer time.

For patients eligible for POD1 stent removal, at the completion of the procedure, the surgeon places the indwelling ureteral stent in a retrograde fashion from the urethra with the patient in either the prone or supine position. The stent is left on its tether and attached to the Foley catheter, allowing for easy removal of both the Foley and the stent the following morning of discharge on POD1. The patients are observed for at least two hours or until they successfully pass a void trial to ensure no issues arise after stent removal. Patients are discharged with scheduled acetaminophen, diclofenac, or a short course of narcotics depending on renal function, tamsulosin daily for two weeks, and stool softeners, with a standardized discharge instruction handout. A followup is scheduled in 8–12 weeks with abdominal X-ray and renal ultrasound.

Baseline demographic data was collected on all patients. Operative and stone characteristics were tabulated and included patient position, length of surgery, stone burden, stone composition, and Guy's stone score, as previously described.¹¹ Stent disposition was recorded by number of days with stent in place (POD1 vs. later stent removal). Concomitant procedures performed included ipsilateral ureteroscopy (endoscopic combined intrarenal surgery, [ECIRS]), cystolitholapaxy, or urethral stricture dilation.

Data on postoperative events were recorded for the 30-day period following stent removal, including patient telephone calls or electronic medical record

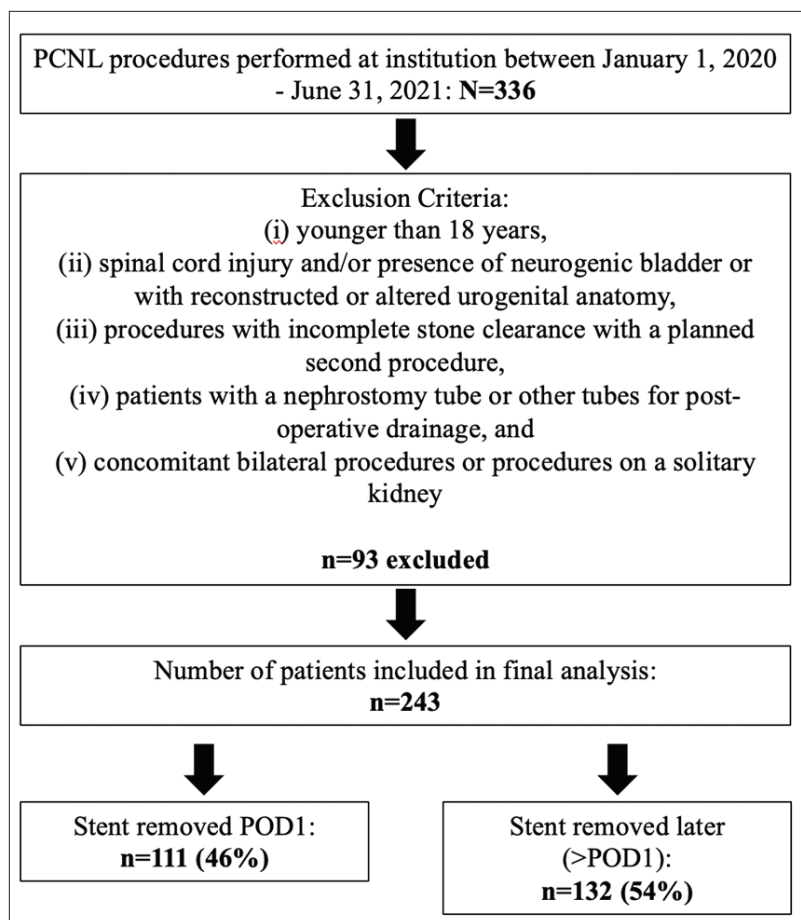


Figure 1. Flow chart indicating the flow of records analyzed, including exclusion criteria, and distribution of patients into final categories for data analysis. PCNL: percutaneous nephrolithotomy; POD: postoperative day.

chat messages, ED visits, and unplanned clinic visits. Postoperative complications were reported using the modified Clavien-Dindo classification, and unplanned secondary procedures were also included as complications. All postoperative phone calls within the defined collection period were logged. Those calls that required intervention (such as medication prescription) were also logged as a complication. Unplanned clinic visits included unplanned telehealth appointments. Clinic visits with other non-urology providers (e.g., primary care physician) were not included. If the patient visited both the ED and had an unplanned clinic visit, both were separately reported.

Statistical analysis

Study data were collected and managed using Research Electronic Data Capture (REDCAP) electronic data capture tools hosted at our institution.^{12,13} REDCAP is a secure, web-based software platform designed to support data capture for research studies. All data analysis was performed using SPSS Statistics software (IBM SPSS Statistics for Windows, version 27.0. Armonk, NY: IBM Corp). Data are presented as means (standard deviations) or proportions (percentages). Per study objectives, analyses were performed comparing group differences (i.e., stent removed POD1 vs. stent removed later) via Chi-squared tests for categorical variables or independent t-tests for continuous variables. Statistical significance was defined as p<0.05 on intraoperative and postoperative clinical outcomes. A multivariable regression analysis was conducted with all demographic and perioperative variables entered as predictors of stent disposition.

RESULTS

Of the 243 included PCNLs performed at our institution, 111 (46%) had stents removed on POD1 and 132 (54%) had stents removed at a later date. For the latter patients, the mean indwelling stent time was six days (range 1–48). Demographics are shown in Table 1. Groups were largely similar, but Black patients were less likely to have stents removed on POD1 (p=0.031).

Operative data are reported in Table 2. There were several variables that demonstrated group differences in proportions of patients who had their stent removed at POD1 vs. later, including surgeon, preoperative drainage, tract size, patient position, operative time, stone burden, stone location, and Guy’s stone score (p<0.03 for all). These differences were primarily due to surgeon variability and how the procedure was performed. Despite these differences, multivariable regres-

Table 1. Demographics data of analyzed groups

Variable	POD1 (%) n=111	Later (%) n=132	Total (%) n=243	Group comparison p	Multivariable regression p
Age (years), mean (SD)	54.4 (15.2)	55.9 (15.6)	55.2 (15.4)	0.444	0.091
Sex				0.909	0.597
Male	53 (45.3%)	64 (48.5%)	117 (48.1%)		
Female	58 (52.3%)	68 (51.5%)	126 (51.9%)		
Race				0.031	0.152
White	105 (94.6%)	107 (81.1%)	212 (7.0%)		
Black or African American	4 (3.6%)	13 (9.8%)	17 (45.3%)		
Asian	0 (0%)	3 (2.3%)	3 (1.2%)		
Other	2 (1.8%)	8 (6.1%)	53 (45.3%)		
Unknown	0 (0%)	1 (0.8%)	1 (0.4%)		
Ethnicity				0.449	0.846
Not Hispanic/Latino	108 (97.3%)	126 (95.5%)	234 (96.8%)		
Hispanic/Latino	3 (2.7%)	6 (4.5%)	9 (3.7%)		
BMI				0.936	0.240
Underweight (<18.5)	3 (2.8%)	2 (1.6%)	5 (2.1%)		
Healthy weight (18.5–24.9)	17 (15.6%)	24 (19.0%)	41 (17.4%)		
Overweight (25–29.9)	28 (25.7%)	32 (25.4%)	60 (25.5%)		
Obese (30–40)	46 (42.2%)	51 (40.5%)	97 (41.3%)		
Morbidly obese (>40)	15 (13.8%)	17 (13.5%)	32 (13.6%)		
Smoking history				>0.268	>0.714
None	68 (61.3%)	71 (54.2%)	139 (57.4%)		
Former	24 (21.6%)	36 (27.3%)	60 (60.0%)		
Current	19 (17.1%)	23 (17.7%)	42 (17.4%)		
History of stones				0.965	0.434
No	26 (23.4%)	31 (23.7%)	57 (23.6%)		
Yes	85 (76.6%)	100 (76.3%)	185 (76.4%)		
ASA score				0.986	0.399
1	5 (4.5%)	5 (3.8%)	10 (4.1%)		
2	52 (46.8%)	61 (46.6%)	113 (46.7%)		
3	52 (46.8%)	62 (47.3%)	114 (47.1%)		
4	2 (1.8%)	3 (2.3%)	5 (2.1%)		
Stone burden				0.011	0.436
<2 cm	49 (44.5%)	42 (31.8%)	91 (37.6%)		
2–5 cm	59 (53.6%)	77 (58.3%)	136 (56.2%)		
>5 cm	2 (1.8%)	13 (9.8%)	15 (6.2%)		
Stone location				<0.001	0.546
Ureter	1 (0.9%)	13 (9.8%)	14 (5.8%)		
Renal	97 (87.4%)	85 (64.4%)	182 (74.9%)		
Both	13 (11.7%)	34 (25.8%)	47 (19.3%)		
Stone analysis				0.06	0.589
Caox	75 (69.4%)	76 (59.4%)	151 (64.0%)		
Caphos	3 (2.8%)	11 (8.6%)	14 (5.9%)		
CA	9 (8.3%)	18 (14.1%)	27 (11.4%)		
Uric acid	13 (12.0%)	14 (10.9%)	27 (11.4%)		
Cystine	2 (1.9%)	0 (0%)	2 (0.8%)		
Struvite	6 (5.6%)	5 (3.9%)	11 (4.7%)		
Other	0 (0%)	4 (3.1%)	4 (1.7%)		

P-values for group comparisons were calculated based on Chi-squared analyses for categorical variables and independent samples t-tests for continuous variables. P-values for multivariable regression analyses were run with age, sex, race, ethnicity, BMI, smoking history, history of stones, ASA score, stone burden, stone location, stone analysis, mixed stone, and Guy’s Stone Score were entered as predictors for this model. ASA: American Society of Anesthesiologists; BMI: body mass index; SD: standard deviation.

Table 1 (cont'd). Demographics data of analyzed groups

Variable	POD1 (%) n=111	Later (%) n=132	Total (%) n=243	Group comparison p	Multivariable regression p
Mixed stone? 'Yes'	61 (57.5%)	59 (46.8%)	120 (51.7%)	0.104	0.148
Guys stone score				0.003	0.989
1	48 (43.2%)	32 (24.6%)	80 (33.2%)		
2	49 (44.1%)	73 (56.2%)	122 (50.6%)		
3	13 (11.7%)	15 (11.5%)	28 (11.6%)		
4	1 (0.9%)	10 (7.7%)	11 (4.6%)		

P-values for group comparisons were calculated based on Chi-squared analyses for categorical variables and independent samples t-tests for continuous variables. P-values for multivariable regression analyses were run with age, sex, race, ethnicity, BMI, smoking history, history of stones, ASA score, stone burden, stone location, stone analysis, mixed stone, and Guy's Stone Score were entered as predictors for this model. ASA: American Society of Anesthesiologists; BMI: body mass index; SD: standard deviation.

Table 2. Operative and stone data between the two groups

	POD1 (%) n=111	Later (%) n=132	Total (%) n=243	Group comparison p	Multivariable regression p
Surgeon				<0.001	0.191
BK	83 (74.8%)	65 (50.0%)	148 (61.4%)		
MS	28 (25.2%)	65 (50.0%)	93 (38.6%)		
PCNL laterality				0.560	0.839
Right	43 (38.7%)	56 (42.4%)	99 (40.7%)		
Left	68 (61.3%)	76 (57.6%)	144 (59.3%)		
Preoperative drainage				0.023	>0.475
Stent	20 (18.0%)	19 (14.4%)	39 (16.0%)		
Neph tube	4 (3.6%)	15 (11.5%)	19 (7.9%)		
Tract size				<0.001	0.602
Standard (>22 F)	33 (29.7%)	72 (54.5%)	105 (43.2%)		
Mini (<22 F)	78 (70.3%)	60 (45.5%)	138 (56.8%)		
Patient position				<0.001	0.912
Supine	84 (75.7%)	70 (53.0%)	154 (63.4%)		
Prone	27 (24.3%)	62 (47.0%)	89 (36.6%)		
Lithotripter				0.165	0.754
Laser	69 (65.7%)	68 (53.5%)	137 (59.1%)		
Shockpulse/trilogy	29 (27.6%)	46 (36.2%)	75 (32.3%)		
Both	7 (6.7%)	13 (10.2%)	20 (8.6%)		
Concomitant procedure	37 (33.3%)	56 (42.4%)	93 (38.3%)	0.146	0.548
Operative time (minutes)	Mean=90.5 (SD=23.0)	Mean=100.6 (SD=30.2)	Mean=96.0 (SD=27.5)	0.004	0.559

P-values for group comparisons were calculated based on Chi-squared analyses for categorical variables and independent samples t-tests for continuous variables. P-values for multivariable regression analyses were run with surgeon, laterality, preoperative drainage, tract size, patient position, lithotripter, concomitant procedure, operative time were entered as predictors for this model. PCNL: percutaneous nephrolithotomy; POD: postoperative day.

sion modeling indicated that no surgeon, operative, or stone variables were significantly related to longer stenting or outcomes (all $p > 0.148$; model: $p < 0.001$).

Postoperative events are summarized in Table 3. There were 76 patients (31.3%) who called or messaged the office after their procedure, and 31 (13%) who went to the ED ($n=26$, 10.7%) and/or clinic ($n=6$, 2.5%). When comparing patients whose stents were removed on POD1 compared to longer stented counterparts, there was no statistically significant difference in telephone calls/messages ($p=0.081$) or ED/clinic visits ($p=0.093$). The most common reason for a telephone call or visit to the ED was flank pain.

Forty-three (17.7%) patients reported a postoperative complication, and this did not differ by stenting group ($p=0.647$). Most complications were either Clavien-Dindo grade I ($n=19$, 44.2%) or II ($n=15$, 34.9%). There were seven grade III complications (16.3%), which included two percutaneous angioplasty procedures by interventional radiology for pseudo-aneurysm-related postoperative bleeding, one ureteroscopy on the contralateral side for obstructing stones, and one stent removal in the operating room for a patient who could not tolerate removal in the office. There was one grade IV complication (ICU admission) and one postoperative mortality. The mortality did not occur at our institution, and the cause of death is unclear. The stent removal was scheduled for the day after this patient's death.

There were three (1.3%) unplanned second-look procedures: two (1.8%) in the POD1 stent removal group (one had presented at an outside hospital for pain and was stented, and second-look ureteroscopy showed no stones, while the other patient was found to have two obstructing 3 mm fragments that were basketed out approximately two weeks postoperatively after ongoing pain); and one (0.8%, $p=0.475$) in the later stent removal group (patient had ureteroscopy on POD1 after PCNL for stone fragment noted alongside the stent on postoperative imaging. That stent was removed 48 hours afterwards via tether at home. The patient then returned two days later with acute kidney injury and fever so a new stent was replaced).

DISCUSSION

Our objective was to determine whether patients who had their stent removed on POD1 presented with more postoperative events or complications as a result of earlier stent removal. POD1 stent removal after an uncomplicated PCNL can be performed safely, with low rates of complications and an acceptable rate of

other postoperative events compared to their counterparts that are stented for longer periods of time. Although a relatively high proportion of patients called in with questions or concerns (31.3%), few required an unplanned clinic appointment, ED visit, or an unplanned secondary procedure, and thus, were managed conservatively. Most commonly, these calls were for pain and simple reassurance or behavioral recommendations (e.g., rest, hydration)

To our knowledge, there is no series in the current literature that directly examined the ideal length of stenting after uncomplicated PCNL. This question has been examined for patients undergoing ureteroscopy in a few published studies. Paul et al examined three- vs. seven-day tethered stent removal in patients who underwent unilateral ureteroscopy and found a non-significant trend towards more post-procedure events (phone calls, ED visits, extra clinic visits) in the earlier stent removal group.¹⁴ Conversely, Komeya et al published a retrospective analysis comparing patients post-flexible ureteroscopy who had stent removed on POD1 vs. their standard, longer-stented counterparts and found no difference in stone-free rates or postoperative complications between groups.¹⁵ More recently, Boyko et al performed a large retrospective cohort study looking at unplanned ED or clinic visits post-ureteroscopy in three groups based on stent duration. They also found no difference in their primary outcome between stent groups.¹⁶ These two latter studies suggest that the indwelling ureteral stent can be safely removed at an earlier date after ureteroscopy, without an increase in postoperative adverse events, and limiting the morbidity associated with prolonged stenting.

In the PCNL literature, studies have demonstrated better pain control and shorter hospital stays in stented patients compared to those with a nephrostomy tube.^{6,7,17} A few studies have examined a stent left on a tether following PCNL and shown the feasibility and safety of this approach. Berkman et al described antegrade placement of a stent, with the tether exiting the flank, which decreased narcotic use and hospital stay compared to standard PCNL.⁹ Shpall et al similarly describe antegrade, tethered stent placement, which was removed in the office 3–12 days after PCNL, with no noted urine leakage or subsequent complication.¹⁰ These studies have not examined duration of stenting, and in neither study were stents removed on POD1.^{9,10}

The benefits of removing a stent on POD1 (vs. later) are important and include reducing stent-associated morbidity; it obviates the inconvenient and often stressful return visits for cystoscopy to remove the

Table 3. Summary of postoperative events and complications between early vs. later stent removal

	POD1 n=111 (% group, % total)	Later (%) n=132 (% group, % total)	Total n=243 (%)	p
Postoperative complications	21 (18.9%, 8.6%)	22 (16.7%, 9.1%)	43 (17.7%)	0.647
Grade I	11 (52.4%, 4.5%)	8 (36.4%, 3.3%)	19 (44.2%)	0.433
Grade II	8 (38.1%, 3.3%)	7 (31.8%, 2.9%)	15 (34.9%)	
Grade III	2 (9.5%, 0.8%)	5 (22.7%, 2.1%)	7 (16.3%)	
Grade IV	0 (0%, 0%)	1 (4.5%, 0.4%)	1 (2.3%)	
Grade V	0 (0%, 0%)	1 (4.5%, 0.4%)	1 (2.3%)	
Phone calls	41 (36.9%, 16.9%)	35 (26.5%, 14.4%)	76 (31.3%)	0.081
ED/clinic visits				
ED	15 (13.5%, 6.2%)	11 (42.3%, 4.5%)	26 (10.7%)	0.193
Clinic	4 (3.6%, 1.6%)	2 (1.5%, 0.8%)	6 (2.5%)	0.296
Chief complaint				
Fever/chills	2 (1.8%, 0.8%)	1 (0.8%, 0.4%)	3 (1.2%)	0.463
Nausea/vomiting	4 (3.6%, 1.6%)	0 (0%, 0%)	4 (1.6%)	0.028
Flank pain	13 (11.7%, 5.3%)	7 (5.3%, 2.9%)	20 (8.2%)	0.070
Bladder pain	1 (0.9%, 0.04%)	1 (0.8%, 0.4%)	2 (0.8%)	0.902
Other	4 (3.6%, 1.6%)	4 (3.0%, 1.6%)	8 (3.3%)	0.803
Unplanned secondary procedure	2 (1.8%, 0.8%)	1 (0.8%, 0.4%)	3 (1.3%)	0.475

P-values for group comparisons were calculated based on Chi-squared analyses for categorical variables and independent samples t-tests for continuous variables. ED: emergency department.

stent; and there are potential cost savings from these unnecessary visits. There do not appear to be significant complications with removing the stent on POD1 after an uncomplicated PCNL. In addition, there were no differences in outcomes based on the surgical approach (e.g., surgeon, tract size, patient position, etc.), and this may speak to the generalizability of safely removing a stent on POD1 regardless of the way the PCNL procedure is carried out as long as the criteria for doing so are met.

There are also advantages of a short-term indwelling stent over a “totally tubeless” approach. For example, stenting with a Foley allows renal decompression after the procedure and allows for the rapid identification of patients with severe bleeding that may need additional procedures. Many patients live far away and express a preference to stay overnight, and this allows them to be discharged the next day without any tubes. Anecdotally, we have placed 5 F ureteral catheters postoperatively for removal on POD1 that have caused renal pelvis perforation and medial urinomas on two occasions, and have since reverted to stent placement instead, with the former very seldom used for postoperative drainage. We cannot ascertain the causality of this relationship, so this may be considered a correlation until further evidence is provided.

Limitations

There are several limitations to the current study. The study was retrospective in design and our baseline group demographics were similar save for race, although the exact reason why more patients identifying as Black or African American had their stents removed later is unknown from the dataset. Given our small sample size of patients identifying as Black or African American (n=17, 7.0% with n=4 or 3.6% in the POD I group and n=13 or n=9.8% in the later group), post-hoc comparisons were not possible; however, recent literature has suggested that Black race is a correlate of kidney stone disease prevalence and comorbidities.¹⁸ A recent 50-year systematic review of several large epidemiologic studies¹⁹ suggesting disproportionate increases in incidence and prevalence of kidney stone disease among Black individuals, with health disparities further exacerbating these issues. Some work has also indicated that Black patients wait disproportionately long for surgery compared to other races and ethnicities, and that this may further interact with insurance status.²⁰

Another limitation due to the retrospective and descriptive/exploratory nature of this study is that prospective randomization could not occur. This represents an important future direction. On this point, additional post-hoc analyses of effect size were also not included in our group comparisons. Stone-free rates were not measured in our series, given that long-term metrics were not tracked via this retrospective review; however, on a practical basis, only two patients required a secondary unplanned procedure as a result of the stent being removed on POD I, only one of which was found to have residual stones.

We also consider that confounding variables may have impacted results, given that individual surgeons could affect both operative “exposure” variables, as well as postoperative complications or calls (i.e., “outcome” variables).

Finally, given the suggestion from one of our reviewers that we test for multicollinearity to indicate any correlation between surgeon and certain operative variables, collinearity diagnostics were run. Values were acceptably low (VIF between 1–5) in model 1, with similarly low values in model 2, save for surgeon (VIF=6.00) and patient positioning (VIF=5.40), which is a reflection of differences in clinical practice between the two surgeons who performed all PCNLc at our institution. Collinearity diagnostics were within an acceptably low range for all other variables in our model, suggesting no additional consideration was needed.

Future directions

Future directions could assess patient quality of life following PCNL, with the purpose of better determining patient experience across groups and better accounting for the patient experiences and preferences. We hypothesize that patients who have the stent removed on POD I after PCNL are more satisfied than their longer stented counterparts because of the elimination of both stent colic and office visit for stent removal. Additionally, more extensive pre- and postoperative patient counselling, with a focus on postoperative pain, remains an important need, given the relatively high amount of telephone calls and unplanned visits related to pain control that were ultimately conservatively managed in most patients.

CONCLUSIONS

In a limited, retrospective review, stent removal on POD I after uncomplicated PCNL did not lead to an increase in short-term postoperative phone calls, complications, or ED/clinic visits compared to their longer stented counterparts.

COMPETING INTERESTS: The authors do not report any competing personal or financial interests related to this work.

This paper has been peer-reviewed.

REFERENCES

- Assimos D, Krambeck A, Miller NL, et al. Surgical management of stones: American Urological Association/Endourological Society Guideline, part II. *J Urol* 2016;196:1161. <https://doi.org/10.1016/j.juro.2016.05.091>
- Daww C, Wolf S. Fundamentals of upper urinary tract drainage. In *Campbell-Walsh-Wein Urology* vol. 1 160-184 (Elsevier, Inc, 2021).
- Jou YC, Cheng MC, Sheen JH, et al. Cauterization of access tract for nephrostomy tube-free percutaneous nephrolithotomy. *J Endourol* 2004;18:547-9. <https://doi.org/10.1089/end.2004.18.547>
- Shima AM, Elshal AM. Nephrostomy tube placement after percutaneous nephrolithotomy: Critical evaluation through a prospective randomized study. *Urology* 2012;79:771-6. <https://doi.org/10.1016/j.jurology.2011.09.042>
- Etemadian M, Soleimani MJ, Haghighi R, et al. Does bleeding during percutaneous nephrolithotomy necessitate keeping the nephrostomy tube? A randomized controlled clinical trial. *Urol J* 2011;8:21-6.
- Shen P, Liu Y, Wang J. Nephrostomy tube-free vs. nephrostomy tube for renal drainage after percutaneous nephrolithotomy: A systematic review and meta-analysis. *Urol Int* 2012;88:298-306. <https://doi.org/10.1159/000332151>
- Agrawal MS, Sharma M, Agarwal K. Tubeless percutaneous nephrolithotomy using antegrade tether: A randomized study. *J Endourol* 2014;28:644-8. <https://doi.org/10.1089/end.2013.0693>
- Joshi HB, Stainthorpe A, Macdonagh RP, et al. Indwelling ureteral stents: Evaluation of symptoms, quality of life and utility. *J Urol* 2003;169:1065-9. <https://doi.org/10.1097/01.ju.0000048980.33855.90>
- Berkman DS, Lee MW, Landman J, et al. Tubeless percutaneous nephrolithotomy (PCNL) with reversed Polaris loop stent: reduced postoperative pain and narcotic use. *J Endourol* 2008;22:2245-9. <https://doi.org/10.1089/end.2008.9723>
- Shipall AI, Parekh AR, Bellman GC. Tubeless percutaneous nephrolithotomy with antegrade stent tether: Clinical experience. *J Endourol* 2007;21:973-6. <https://doi.org/10.1089/end.2006.9924>

11. Thomas K, Smith NC, Hegarty N, et al. The Guy's stone score — grading the complexity of percutaneous nephrolithotomy procedures. *Urology* 2011;78:277-81. <https://doi.org/10.1016/j.urology.2010.12.026>
12. Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCAP) — a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377-81. <https://doi.org/10.1016/j.jbi.2008.08.010>
13. Harris PA, Taylor R, Minor BL, et al. The redcap consortium: Building an international community of software platform partners. *J Biomed Inform* 2019;95:103208. <https://doi.org/10.1016/j.jbi.2019.103208>
14. Paul CJ, Brooks NA, Ghareeb GM, et al. Pilot study to determine optimal stent duration following ureteroscopy: Three vs. seven days. *Curr Urol* 2018;11:97-102. <https://doi.org/10.1159/000447201>
15. Komeya M, Usui K, Asai T, et al. Outcome of flexible ureteroscopy for renal stone with overnight ureteral catheterization: A propensity score-matching analysis. *World J Urol* 2018;36:1871-6. <https://doi.org/10.1007/s00345-018-2328-1>
16. Boyko AW, Merheb S, Hill S, et al. Ureteral stenting after routine ureteroscopy: Is earlier stent removal feasible? *Can J Urol* 2021;28:10865-70.
17. Minami T, Yamana H, Matsui H, et al. Postoperative outcomes after tubeless, totally tubeless, standard, and standard with ureteral stent percutaneous nephrolithotomy: A nationwide retrospective study in Japan. *Urol Int* 2020;104:445-51. <https://doi.org/10.1159/000505103>
18. Akoudad S, Szklo M, McAdams MA, et al. Correlates of kidney stone disease differ by race in a multi-ethnic middle-aged population: The ARIC study. *Prev Med* 2010;51:416-20. <https://doi.org/10.1016/j.ypmed.2010.08.011>
19. Crivelli JJ, Maalouf NM, Paiste HJ, et al. Disparities in kidney stone disease: A scoping review. *J Urol* 2021;206:517-25. <https://doi.org/10.1097/JU.0000000000001846>
20. Turner EN, Talwar R, Familusi OO, et al. Race/Ethnicity and insurance's impact on delays to kidney stone surgery scheduling. *Urology* 2022;163:196-201. <https://doi.org/10.1016/j.urology.2022.01.070>

CORRESPONDENCE: Dr. Tasha Posid, Department of Urology, Ohio State University Medical Center, Columbus, OH, United States; Tasha.Posid@osumc.edu