# Ureteral Stent Decompression is Associated with Decreased Length of Stay Compared to Percutaneous Nephrostomy Tube in Patients with Obstructing Infected Ureteral Stones

Albert S Ha, MD[1]; Gregory W Hruby, PhD[2]; David S Han, MD, MS[1]; Rainjade Chung, MD[1]; Jeffrey Johnson, MD[3]; Isaac H Michaels, MPH[2]; Aaron Brant, MD[3]; Christina Sze, MD, MS[3]; Ananias M Burgos, MD[3]; Spyridon Basourakos, MD[3]; Patrick Lewicki, MD[3]; Timothy McClure, MD, MPH[3]; and Ojas Shah, MD[1]

COLUMBIA UNIVERSITY DATA SCIENCE INSTITUTE

[1] Columbia University Irving Medical Center, Department of Urology, New York, NY
[2] New York Presbyterian Analytics Department, New York, NY
[3] Weill Cornell Medical College, Department of Urology, New York, NY

NewYork-Presbyterian

## Introduction and Purpose

- Obstructing ureteral stone with urinary tract infection is a urologic emergency requiring prompt decompression to prevent renal impairment, severe morbidity, and mortality.
- The American Urologic Association recommends drainage of the obstructed kidney with either a ureteral stent or percutaneous nephrostomy tube (PCN) to prevent adverse outcomes.[1]
- The advantages between ureteral stent vs. PCN are less established and at the discretion of the urologist.
- We compared patient and hospital-related outcomes in the management of obstructing infected ureteral stones via ureteral stent vs. PCN.

## Materials and Methods

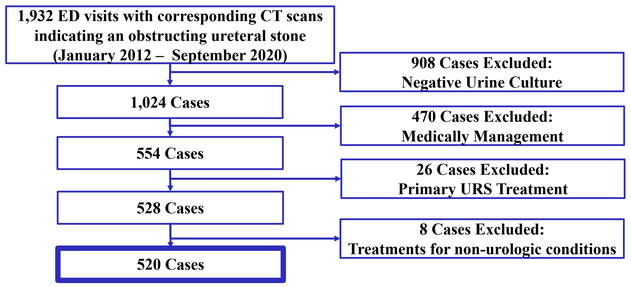


**Figure 2. Consort Flow Diagram for Case Selection**

**Cohort Selection:**

- Non-administrative clinical data were used to construct a regular expression algorithm extracting urologic features from CT reports: Genitourinary and Impression sections, ureteral stones, hydronephrosis, stranding, and presence of staghorn stone.
- Using a 5% random sample of labeled obstructive and non-obstructive ureteral stones, the positive (PPV) and negative predictive values (NPV) were calculated to evaluate the expression algorithm.
- Overall, the obstructive nephrolithiasis phenotype had a PPV of 91.8% and NPV of 84.9%
- To identify cases of obstructing ureteral stone with urinary tract infection, the cohort was further defined by ED visit with a positive CT, positive urine culture, and treated with either ureteral stent or PCN placement (2012-2020)

**Study Design**: Case-Control Study
**Database**: New York-Presbyterian Enterprise Data Warehouse
**Outcomes**:
[1] Intensive Care Unit Utilization
[2] Positive Blood Culture
[3] Length of Stay (LOS) ≥4 Days

## Results

| | PCN | Ureteral Stent Placement | Overall |
|---|---|---|---|
| | (N=105) | (N=415) | (N=520) |
| combined_race_ethnicity_new | | | |
| Other/Unknown | 31 (29.5%) | 118 (28.4%) | 149 (28.7%) |
| Non-Hispanic White | 38 (36.2%) | 122 (29.4%) | 160 (30.8%) |
| Hispanic White | 19 (18.1%) | 101 (24.3%) | 120 (23.1%) |
| Black | 9 (8.6%) | 51 (12.3%) | 60 (11.5%) |
| Asian | 8 (7.6%) | 23 (5.5%) | 31 (6.0%) |
| facility_id | | | |
| Cornell | 64 (61.0%) | 201 (48.4%) | 265 (51.0%) |
| Columbia | 41 (39.0%) | 214 (51.6%) | 255 (49.0%) |
| sex | | | |
| F | 58 (55.2%) | 299 (72.0%) | 357 (68.7%) |
| M | 47 (44.8%) | 116 (28.0%) | 163 (31.3%) |
| age_at_ed | | | |
| Mean (SD) | 66.6 (16.7) | 57.8 (18.9) | 59.6 (18.8) |
| Median [Min, Max] | 67.0 [26.0, 95.0] | 59.0 [16.0, 101] | 61.0 [16.0, 101] |
| cci | | | |
| Mean (SD) | 4.80 (4.55) | 2.60 (3.60) | 3.05 (3.90) |
| Median [Min, Max] | 3.00 [0, 17.0] | 1.00 [0, 15.0] | 1.00 [0, 17.0] |
| sepsis_criteria | | | |
| No | 28 (26.7%) | 191 (46.0%) | 219 (42.1%) |
| Yes | 77 (73.3%) | 224 (54.0%) | 301 (57.9%) |
| hydro_final | | | |
| None/Unspecified Hydro | 2 (1.9%) | 15 (3.6%) | 17 (3.3%) |
| Mild | 33 (31.4%) | 169 (40.7%) | 202 (38.8%) |
| Moderate | 52 (49.5%) | 192 (46.3%) | 244 (46.9%) |
| Severe | 18 (17.1%) | 39 (9.4%) | 57 (11.0%) |
| time_from_ed_to_procedure_hours | | | |
| Mean (SD) | 67.1 (179) | 38.7 (99.4) | 44.4 (120) |
| Median [Min, Max] | 15.3 [3.62, 1270] | 14.4 [1.88, 1360] | 14.6 [1.88, 1360] |
| Missing | 0 (0%) | 4 (1.0%) | 4 (0.8%) |
| positive_blood_culture | | | |
| No | 36 (34.3%) | 169 (40.7%) | 205 (39.4%) |
| Yes | 65 (61.9%) | 157 (37.8%) | 222 (42.7%) |
| Missing | 4 (3.8%) | 89 (21.4%) | 93 (17.9%) |
| los | | | |
| Mean (SD) | 11.6 (13.3) | 6.35 (10.6) | 7.40 (11.4) |
| Median [Min, Max] | 7.00 [1.00, 89.0] | 4.00 [0, 109] | 4.00 [0, 109] |
| icu_utilization | | | |
| No | 65 (61.9%) | 327 (78.8%) | 392 (75.4%) |
| Yes | 40 (38.1%) | 88 (21.2%) | 128 (24.6%) |

## Results

Multivariable Logistic Regression for Outcomes of ICU Utilization, Positive Blood Culture, and LOS ≥4 Days

| | ICU Utilization | | Positive Blood Cultures | | LOS ≥4 Days | |
|---|---|---|---|---|---|---|
| **Covariates** | **OR [95% CI]** | **p-value** | **OR [95% CI]** | **p-value** | **OR [95% CI]** | **p-value** |
| Decompression Type | | | | | | |
| Nephrostomy Tube | Reference | - | Reference | - | Reference | - |
| Ureteral Stent | 0.63 [0.33, 1.21] | 0.160 | 0.51 [0.28, 0.90] | 0.021 | 0.37 [0.17, 0.77] | <0.001 |
| Age | 1.01 [1.00, 1.03] | 0.097 | 1.03 [1.01, 1.04] | 0.001 | 1.04 [1.02, 1.05] | <0.001 |
| Sex | | | | | | |
| Female | Reference | - | Reference | - | Reference | - |
| Male | 0.82 [0.42, 1.54] | 0.540 | 0.61 [0.35, 1.05] | 0.079 | 0.84 [0.42, 1.65] | 0.610 |
| Race | | | | | | |
| Other/Unkown | Reference | - | Reference | - | Reference | - |
| Non-Hispanic White | - | - | - | - | 0.57 [0.29, 1.12] | 0.100 |
| Hispanic White | - | - | - | - | 0.56 [0.27, 1.14] | 0.110 |
| Black | - | - | - | - | - | - |
| Asian | - | - | - | - | - | - |
| Facility | | | | | | |
| Academic Center 1 | Reference | - | Reference | - | Reference | - |
| Academic Center 2 | 1.56 [0.88, 2.79] | 0.130 | - | - | - | - |
| Charlson Comorbidity Index | 1.09 [1.01, 1.18] | 0.040 | 0.99 [0.93, 1.06] | 0.780 | 1.08 [0.99, 1.18] | 0.083 |
| Sepsis Criteria* | 4.32 [2.36, 8.25] | <0.001 | 2.67 [1.60, 4.54] | <0.001 | 1.51 [0.81, 2.83] | 0.199 |
| Time to Procedure (hours)** | 1.002 [0.999, 1.003] | 0.230 | 1.002 [1.000, 1.004] | 0.070 | 1.026 [1.013, 1.044] | <0.001 |
| Hydronephrosis | | | | | | |
| None/Unspecified | Reference | - | Reference | - | Reference | - |
| Mild | 2.84 [0.58, 21.08] | 0.230 | 1.31 [0.38, 4.92] | 0.670 | 1.16 [0.23, 6.20] | 0.860 |
| Moderate | 2.96 [0.61, 21.81] | 0.210 | 1.41 [0.41, 5.24] | 0.590 | 1.46 [0.30, 7.82] | 0.650 |
| Severe | 2.17 [0.38, 17.75] | 0.410 | 0.36 [0.08, 1.61] | 0.170 | 1.51 [0.24, 10.06] | 0.660 |
| Positive Blood Culture | - | - | - | - | 3.45 [1.91, 6.38] | <0.001 |

** Defined as time from entering the Emergency Department to start of decompressive procedure (hours)
* Defined as ≥2 SIRS criteria with confirmed or suspected source of infection (urinary)
OR: Odds Ratio | CI: Confidence Interval | LOS: Length of Stay | ICU: Intensive Care Unit

**Figure 3. Backwards stepwise multivariable logistic regression models assessing outcomes of ureteral stent vs. percutaneous nephrostomy tube placement**

## Conclusions

- Meeting sepsis criteria, prolonged time to decompression, and greater Charlson Comorbidity Index were associated with worse outcomes in patients with obstructing infected ureteral stones.
- Ureteral stent placement was associated with reduced LOS and decreased likelihood of positive blood cultures; underlying surgical selection on part of the urologist may be involved.
- Strengths include the use of direct EMR database and large sample sizes from two large tertiary centers; weaknesses include its retrospective, observational design and institutional differences in stone management protocols

## References

1. Assimos D, Krambeck A, Miller NL, et al. Surgical Management of Stones: American Urological Association/Endourological Society Guideline, PART II. *J Urol.* 2016;196(4):1161-1169.