2023 Residents & Fellows Competition Winner

ENGAGE WITH QUALITY IMPROVEMENT AND PATIENT SAFETY (E-QIPS)

Multi-Disciplinary Development and Implementation of a Trial of Void Algorithm to Standardize and Reduce Indwelling Urethral Catheter Use

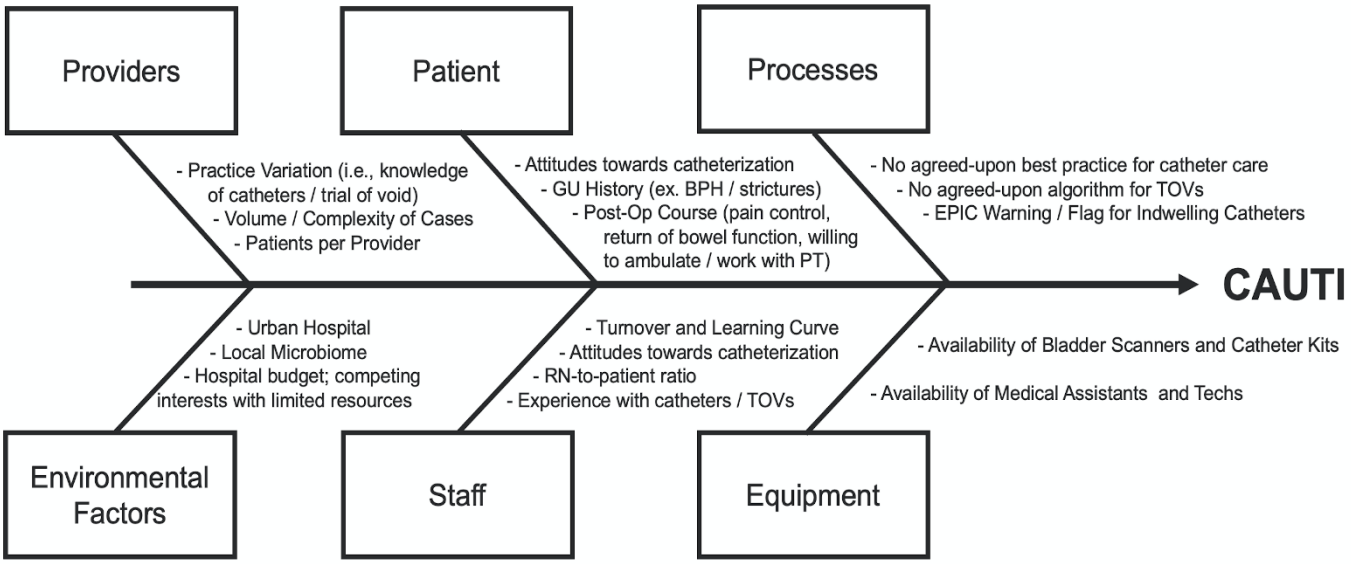
David S. Han, MD, MS

American Urological Association

QUALITY OR SAFETY PROBLEM

Indwelling catheter use is common, with 15-25% of patients undergoing catheter placement during hospitalization.[1] Prolonged indwelling catheter use is associated with extended hospitalization and catheter-associated urinary tract infections (CAUTIs).[2,3] Despite a shared consensus to minimize preventable hospital-acquired infections,[1] various interrelated factors associated with catheter care result in CAUTIs (**Figure 1**). In 2022, our surgical Step-Down Unit was deemed a CAUTI target unit by our hospital's Infection Prevention & Control team for high CAUTI rates (n=6 over 12 months).

Figure 1: Ishikawa Fishbone Diagram.



BACKGROUND

Though recommendations exist to minimize CAUTIs,[1] catheter use varies due to the numerous competing influences surrounding patient care (**Figure 1**). Optimizing post-operative patients for trial of voids and standardizing voiding trial parameters may reduce duration of catheter use. Various modifiable predictors exist for successful voiding trials, such as prescribing alpha-1 adrenergic receptor antagonists and minimizing post-operative opioid use.[4-9] While these protocols are helpful,[10,11] few preemptively optimize patients before catheter removal.

PROJECT OBJECTIVES

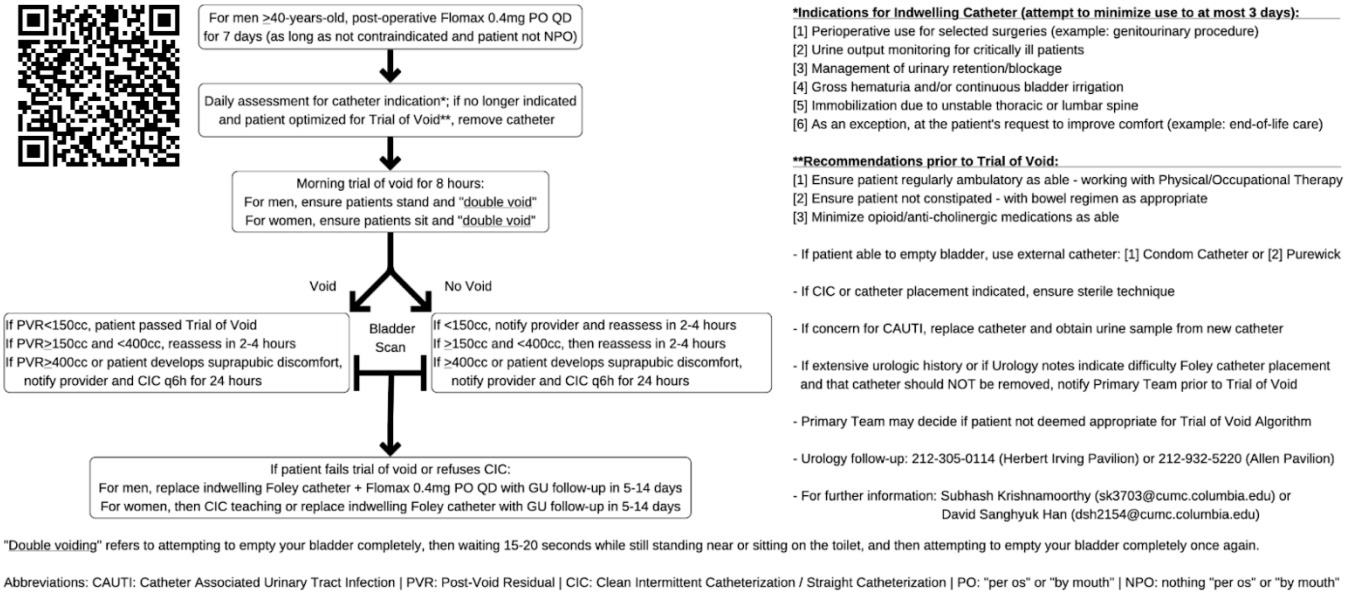
The overall objective of this project was to curtail duration of catheterization by standardizing a trial of void protocol in a post-operative hospital unit. A secondary objective was to reduce the incidence of CAUTIs in this unit. Specific aims were: [1] to develop an evidence-based trial of void algorithm, and [2] to implement the algorithm by engaging with providers and nursing staff.

INTERVENTION

The intervention was a trial of void algorithm designed with input from urologists, general surgeons, nursing leadership, and nursing staff (**Figure 2**). Implementation was performed by introducing the algorithm during daily nursing huddles, leading up to launch on October 31, 2022. The study investigators

and staff met as a committee every 2 weeks. A committee representative in turn met directly with nursing staff every 4 weeks to garner feedback and share measured outcomes.

Figure 2: Trial of Void Algorithm.



MEASURES OF SUCCESS

The primary outcomes were: (1) change in mean cumulative indwelling urethral catheter days* 90-days before and after algorithm launch and (2) change in catheter use variation (range, interquartile ratio, standard deviation, and variance). Total patient days on the Step-Down Unit (surrogate for patient volume), urinary catheter days, and number of CAUTIs were also measured as secondary outcomes, and these data points are all nationally reported outcomes defined by the Centers for Disease Control and Prevention (CDC).[12] We measured these outcomes on a surgical unit where the algorithm was not implemented as a natural control.

*Cumulative catheter days reflects the total time patients were catheterized in the unit. For example, if 2 patients had indwelling catheters for 3 and 7 days respectively, then the cumulative catheter days would be 10. Suprapubic tubes, nephrostomy tubes, percutaneous nephroureteral tubes, and catheterized urinary conduits/diversions were excluded from analysis.

OUTCOMES

The mean number of patient days before and after algorithm introduction did not differ on the Step-Down Unit (32.2 vs. 32.0, p=0.60). After implementation, mean cumulative catheter days decreased (14.8 vs. 9.9, p<0.01, Figure 3), as did mean daily number of patients with catheters (3.8 vs. 3.2, p=0.01) and the mean urinary catheter days (3.7 vs. 3.1, p=0.02); measures of catheter use variation also decreased (Table 1). There was one CAUTI before and after algorithm implementation, the latter deemed potentially associated with unnecessary catheterization and algorithm non-adherence on root-cause analysis. Measures of catheter use in the surgical floor control group did not differ for any outcome (p>0.05), suggesting that pattern changes in catheter use on the Step-Down Unit were due to the trial of void algorithm. Unintended consequences of the quality improvement initiative included nursing staff more routinely documenting trial of voids with post-void residual bladder scans in the electronic medical record. Additionally, the recurrent nursing staff meetings allowed for more direct communication regarding patient care needs (ex. requesting male external urinary catheters when appropriate). In January 2023, the surgical Step-Down Unit was no longer a target unit for CAUTIs.

Figure 3: Control Chart of Total Cumulative Catheter Days.

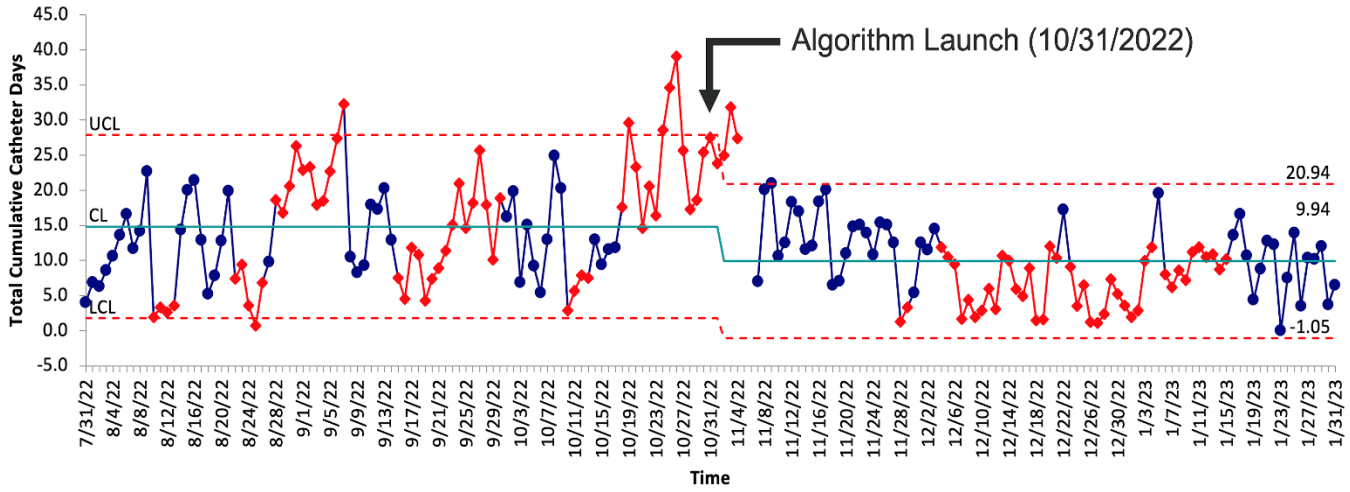


Table 1: Primary and Secondary Outcomes 90-Days Before and After Trial of Void Algorithm Implementation on Surgical Step-Down Unit and Surgical Floor Control.

	Surgical Step-Down Unit			Surgical Floor Control		
Standardized Outcomes Outlined by the CDC	**Before**	**After**	**p-value**	**Before**	**After**	**p-value**
Mean Patient Days	32.2	32.0	0.60	31.5	31.0	0.08
Mean Urinary Catheter Days	3.7	3.1	0.02	5.0	4.4	0.08
Number of CAUTI's	1	1	N/A	0	0	N/A
Hospital-Specific Measured Outcomes	**Before**	**After**	**p-value**	**Before**	**After**	**p-value**
Mean Cumulative Catheter Days	14.8	9.9	<0.01	12.5	12.6	0.89
Mean Number of Patients with Catheters	3.8	3.2	0.01	4.5	4.5	0.93
Variation Measures for Cumulative Catheter Days			N/A			N/A
Range	38.4	31.8		51.6	40.7	
Interquartile Range	11.9	7.1		9.4	11.1	
Standard Deviation (σ)	8.1	6.1		7.8	7.9	
Variance (σ^2)	65.1	37.5		60.0	62.1	

Abbreviations: CDC: Centers for Disease Control and Prevention | CAUTI: Catheter-Associated Urinary Tract Infection

POTENTIAL IMPACT AND SCALABILITY

The trial of void algorithm led to lower overall indwelling catheter use, fewer daily number of patients with catheters, and decreased variation in catheter care. These results suggest that a concerted multi-disciplinary effort between nurses and surgeons can decrease catheter use without affecting patient care volume. The algorithm is publicly available via QR code (Figure 2), which includes creator contact information for any questions or comments during scaling.

SUSTAINING THE CHANGES

We plan to sustain this change by meeting with hospital leadership (March 2023) to discuss expanding the algorithm to other patient floors and eventual hospital-wide implementation. Monthly meetings between the research committee and nursing staff will provide continued opportunities for feedback and improvement.

ADDITIONAL RESOURCES

The CDC website provides valuable resources and information that can be used to guide similar initiatives to minimize CAUTIs.

KEY SUMMARY

a. A multi-disciplinary approach to standardize catheter care with an evidence-based trial of void algorithm is feasible and effective in reducing catheter use without affecting patient volume.
b. Mean cumulative indwelling urethral catheter days decreased (14.8 vs. 9.9 days) with simultaneous decreases in catheter care variation.
c. Mean daily number of patients with indwelling catheters decreased (3.8 vs. 3.2 patients).

REFERENCES

1. Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA. Guideline for prevention of catheter-associated urinary tract infections 2009. Infect Control Hosp Epidemiol. 2010;31(4):319-326.
2. Emberton M, Fitzpatrick JM. The Reten-World survey of the management of acute urinary retention: preliminary results. BJU Int. 2008;101 Suppl 3:27-32.
3. Fitzpatrick JM, Desgrandchamps F, Adjali K, et al. Management of acute urinary retention: a worldwide survey of 6074 men with benign prostatic hyperplasia. BJU Int. 2012;109(1):88-95.
4. Agrawal K, Majhi S, Garg R. Post-operative urinary retention: Review of literature. World Journal of Anesthesiology. 2019;8:1-12.
5. Boccola MA, Sharma A, Taylor C, Wong LM, Travis D, Chan S. The infusion method trial of void vs standard catheter removal in the outpatient setting: a prospective randomized trial. BJU Int. 2011;107 Suppl 3:43-46.
6. Elmansy H, Shabana W, Ahmad A, et al. Factors Predicting Successful Same-Day Trial of Void (TOV) After Laser Vaporization of the Prostate. Urology. 2022;165:280-284.
7. Dong X, Pan C, Wang D, et al. Bladder Backfilling versus Standard Catheter Removal for Trial of Void after Outpatient Laparoscopic Gynecologic Surgery: A Systematic Review and Meta-Analysis. J Minim Invasive Gynecol. 2022;29(2):196-203.e191.
8. Mowat A, Brown B, Pelecanos A, Mowat V, Frazer M. Infusion-fill method versus standard auto-fill trial of void protocol following a TVT-exact procedure: A randomised controlled trial. Aust N Z J Obstet Gynaecol. 2018;58(5):564-569.
9. Yoon PD, Chalasani V, Woo HH. Systematic review and meta-analysis on management of acute urinary retention. Prostate Cancer Prostatic Dis. 2015;18(4):297-302.
10. Cutright J. The effect of the bladder scanner policy on the number of urinary catheters inserted. J Wound Ostomy Continence Nurs. 2011;38(1):71-76.
11. Pierson M, Cretella B, Roussel M, Byrne P, Parkosewich J. A Nurse-Led Voiding Algorithm for Managing Urinary Retention After General Thoracic Surgery. Crit Care Nurse. 2022;42(1):23-31.
12. Centers for Disease Control and Prevention. National Healthcare Safety Network (NHSN) patient safety component manual. Available at: https://www.cdc. gov/nhsn/pdfs/pscmanual/pcsmanual_current.pdf. Accessed 14 December 2022.

PROJECT LEAD CONTACT INFORMATION

David S. Han, MD, MS

Urology Resident Physician, PGY-4

Department of Urology & General Surgery, Columbia University Irving Medical Center

dsh2154@cumc.columbia.edu

NOTABLE CONTRIBUTORS

Subhash Krishnamoorthy, MD (Assistant Professor of Surgery); David M. Weiner, MD (Assistant Professor of Urology, Director of Acute Care Urology); Christopher B. Anderson, MD, MPH (Assistant Professor of Urology, Program Director); Gina M. Badalato, MD (Assistant Professor of Urology, Vice Chair of Education); Lovie Marie Amolo; Hersy Conteras; Maureen Lowers Roach; Bridgette Bennett; Maria Sofia Luga; Shelly-Anne Layne; Coraima Rihan Veliz