Evaluating the Incidence of Bacteriuria in Female Patients Before and After Implementation of **External Catheter Devices**



BACKGROUND

- Bacteriuria in patients with indwelling urinary catheters is commonly linked to inappropriate antibiotic use and increased risk of adverse effects
- In an attempt to reduce bacteriuria and subsequent catheter-associated urinary tract infections (CAUTI), the use of external catheter devices (ECD) has increased in recent years
- The evidence surrounding reduction of bacteriuria incidence with ECDs is primarily based on data from the male population where these devices have been in use for >10 years
- Currently no studies have shown a similar benefit in females who may be at higher risk of developing an infection based on anatomical differences
- The aim of the current study is to characterize the incidence of bacteriuria in female patients with ECDs and determine the impact it has on inappropriate antibiotic use

STUDY DESIGN & METHODS

- Quasi-experimental study at University of Maryland Medical Center (UMMC)
- Adult female ICU patients with urinary catheters placed within 18 months before and after the implementation of female ECDs in 6/2017
 - Pre-ECD implementation (indwelling only): 12/2015 5/2017
 - Post-ECD implementation (indwelling or external): 12/2017 6/2019
- Two distinct analyses:
 - **Population-level:**
 - Aggregate data was compiled for population-level urinary catheter placement, antimicrobial use, and rates of positive urine cultures
 - <u>Primary outcome</u>: incidence of positive urine cultures per 1,000 patient days
 - Secondary outcomes: rate of indwelling urinary catheter use pre vs. post-ECD, antibiotic prescribing pre vs. post-ECD
 - Patient-level :
 - *a priori* subgroup of medical/surgical ICU patients
 - <u>Primary outcome</u>: antibiotic appropriateness* for GU-UTI indication pre vs. post-ECD
 - <u>Secondary outcomes</u>: incidence of positive urine cultures, antibiotic prescribing pre vs. post-ECD

*Antibiotic appropriateness: prescribed in the presence of a positive urine culture, clinical signs and symptoms of UTI, and urinary tract infection order indication

- Statistical analysis:
 - Bivariate analysis used for comparisons including X² or Fisher's Exact (FE) Test for nominal variables; Student t-test or Mann Whitney U test for continuous variables
 - Segmented regression of interrupted time series (ITS) analysis with negative binomial distribution to evaluate changes in trend and level in rates of positive urine cultures per 1,000 patient days pre- versus post-ECD
 - Analyses were performed with SAS version 9.4 (SAS Institute, Cary, NC).

Mandee Noval, PharmD¹, Surbhi Leekha, MBBS², Michael Armahizer, PharmD, BCCCP³, Abigale Celotto, DNP, AGACNP⁴, Meghna Bhatt, PharmD Candidate¹, Kimberly Claeys, PharmD, BCPS¹ [1] Department of Pharmacy, University of Maryland School of Pharmacy, Baltimore, Maryland, USA; [2] Department of Medicine, University of Maryland School of Medicine, Baltimore, Maryland, USA;

[3]Department of Pharmacy, University of Maryland Medical Center, Baltimore, Maryland, USA; [4] Department of Nursing, University of Maryland Medical Center, Baltimore, Maryland, USA



Take-home Points: The use of external catheter devices may be beneficial in reducing bacteriuria and related antibiotic use among female ICU patients.

Population Level: Baseline Characteristics

	Pre-ECD	Post-ECD	P-value
Mean Age, years (SD)	59 (15)	59 (15)	1.00
Median Elixhauser score (IQR)	6 (3)	6 (3)	1.00
Intensive care unit			
Medical	757 (22.2)	833 (21.8)	0.72
Surgical	840 (24.6)	938 (24.6)	0.97
Neurocritical care	880 (25.8)	1050 (27.5)	0.10
Cardiac surgery	938 (27.4)	998 (26.1)	0.21
Catheter Type Indwelling External	3381 (100) 0 (0)	3213 (68.4) 1485 (31.6)	<0.001
Positive UA Leukocyte esterase WBC >10 cfu/mL Nitrite	3994 (45.2) 2679 (31.1) 306 (3.5)	1063 (28.2) 1091 (30.2) 135 (3.7)	<0.001 0.33 0.59

Population Level: Aggregate Changes Pre- versus Post-ECD

- 2201 patients included in pre-ECD group; 2439 patients included in post-ECD group
- Rate of positive urine cultures, pre vs. post: 38/1,000 vs 28/1,000 patient days, P=0.004
- Antibiotic prescribing (days of therapy), pre vs. post: 1.9/1,000 patient days vs 1.8/1,000 patient days, P = 0.7

• Monthly indwelling catheter use, pre vs. post: 182/1,000 vs 166/1,000 patient days, P = 0.03

Population Level: Interrupted Time Series Analysis



Population Level: Microbiology Results

Pre-ECD (n=706)	Post-ECD (n=594)	P-value
129 (18.8)	165 (27.8)	<0.001
41 (5.8)	62 (10.4)	<0.001
19 (2.7)	16 (2.7)	0.99
17 (2.4)	32 (5.4)	0.005
5 (0.8)	11 (1.9)	0.06
13 (1.8)	3 (0.5)	0.03
40 (5.7)	38 (6.4)	0.58
11 (1.6)	12 (10.4)	0.53
8 (1.1)	3 (0.5)	0.22
312 (44.2)	152 (25.6)	<0.001
40 (5.7)	29 (4.9)	0.53
50 (7.1)	50 (8.4)	0.37
21 (3.0)	21 (3.5)	0.57
	Pre-ECD (n=706)129 (18.8)41 (5.8)19 (2.7)17 (2.4)5 (0.8)13 (1.8)40 (5.7)11 (1.6)8 (1.1)312 (44.2)40 (5.7)50 (7.1)21 (3.0)	Pre-ECD (n=706)Post-ECD (n=594) $129 (18.8)$ $165 (27.8)$ $41 (5.8)$ $62 (10.4)$ $19 (2.7)$ $16 (2.7)$ $17 (2.4)$ $32 (5.4)$ $5 (0.8)$ $11 (1.9)$ $13 (1.8)$ $3 (0.5)$ $40 (5.7)$ $38 (6.4)$ $11 (1.6)$ $12 (10.4)$ $8 (1.1)$ $3 (0.5)$ $312 (44.2)$ $152 (25.6)$ $40 (5.7)$ $29 (4.9)$ $50 (7.1)$ $50 (8.4)$ $21 (3.0)$ $21 (3.5)$

Patient Level: Clinical Outcomes

	Pre-ECD	Post-ECD	<i>P</i> -value
Positive urine cultures, n (%)	31/73 (42.5)	33/136 (24.2)	0.0065
Antibiotics prescribed			
Overall	62/73 (84.9)	117/136 (86)	0.83
GU - UTI	11/62 (17.7)	19/117 (16.2)	0.80
Antibiotic Appropriateness			
Overall	60/73 (82.2)	119/136 (87.5)	0.29
GU - UTI	1/11 (9.1)	6/19 (31.6)	0.21

Conclusion

• The use of ECDs in females was associated with lower rates of positive urine cultures • Antibiotic appropriateness improved post-ECD implementation, likely secondary to reduced rates of bacteriuria