

Washington University School of Medicine Digital Commons@Becker

Open Access Publications

2011

Not all nosocomial Escherichia coli bacteriurias are catheter associated

Jonas Marschall

Washington University School of Medicine in St. Louis

Kyle N. Ota

Washington University School of Medicine in St. Louis

Jeffrey P. Henderson

Washington University School of Medicine in St. Louis

David K. Warren

Washington University School of Medicine in St. Louis

Centers for Disease Control and Prevention Epicenters Program

Centers for Disease Control and Prevention

Follow this and additional works at: http://digitalcommons.wustl.edu/open_access_pubs

 Part of the [Medicine and Health Sciences Commons](#)

Recommended Citation

Marschall, Jonas; Ota, Kyle N.; Henderson, Jeffrey P.; Warren, David K.; and Centers for Disease Control and Prevention Epicenters Program, "Not all nosocomial Escherichia coli bacteriurias are catheter associated." *Infection Control and Hospital Epidemiology*.32,11. 1140-1142. (2011).

http://digitalcommons.wustl.edu/open_access_pubs/783

This Open Access Publication is brought to you for free and open access by Digital Commons@Becker. It has been accepted for inclusion in Open Access Publications by an authorized administrator of Digital Commons@Becker. For more information, please contact engeszer@wustl.edu.



CHICAGO JOURNALS



Not All Nosocomial *Escherichia coli* Bacteriurias Are Catheter Associated

Author(s): Jonas Marschall, Kyle N. Ota, Jeffrey P. Henderson, David K. Warren

Reviewed work(s):

Source: *Infection Control and Hospital Epidemiology*, Vol. 32, No. 11 (November 2011), pp. 1140-1142

Published by: [The University of Chicago Press](#) on behalf of [The Society for Healthcare Epidemiology of America](#)

Stable URL: <http://www.jstor.org/stable/10.1086/662587>

Accessed: 03/03/2012 17:10

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at

<http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



The University of Chicago Press and The Society for Healthcare Epidemiology of America are collaborating with JSTOR to digitize, preserve and extend access to Infection Control and Hospital Epidemiology.

<http://www.jstor.org>

RESEARCH BRIEF

Not All Nosocomial *Escherichia coli* Bacteriurias Are Catheter Associated

Urinary tract infections (UTIs) are the most common hospital-acquired infections and are thought to be primarily a consequence of urinary catheterization.¹ Strategies to prevent hospital-acquired UTIs focus almost exclusively on urinary catheter management. However, data to support the assumption that hospital-acquired UTIs can be equated with catheter-associated UTIs are very limited. In a recent editorial for a nationwide survey of practices to prevent hospital-acquired UTIs, the author stated that 80% of these infections were catheter associated but did not provide a reference.²

We performed a 12-month prospective cohort study involving inpatients with *Escherichia coli* bacteriuria (defined as greater than or equal to 5×10^4 colony-forming units/mL in a clean-voided urine culture, or greater than or equal to 5×10^3 colony-forming units/mL in urine culture from a catheterized patient) starting August 1, 2009, at Barnes-Jewish Hospital, a 1,250-bed teaching hospital in Missouri. Adult patients with a first positive urine culture 48 hours or more after admission were included. Urine cultures were performed at the treating physician's discretion. We excluded patients with polymicrobial bacteriuria and/or concurrent, non-*E. coli* bacteremia. Using medical records, the patients' clinical presentation, vital signs, and laboratory, radiological, and pharmacy data were recorded prospectively.

A bacteriuria episode was considered to be catheter associated if a catheter had been in place within 48 hours before urine cultures were obtained. Asymptomatic bacteriuria (ASB) was defined as the absence of urinary symptoms;³ cystitis was defined as the presence of dysuria, frequency, or urinary retention; pyelonephritis was defined as flank pain or tenderness and/or fever (with or without cystitis symptoms). Sepsis was defined using established criteria. We reviewed blood cultures that were obtained within 1 day before or after bacteriuria was diagnosed.

We used SPSS 18 for data analysis. Univariate comparisons of categorical variables were performed with the χ^2 test or Fisher's exact test as appropriate. Continuous independent variables were analyzed using Student's *t* test or the Mann-Whitney *U* test. A 2-sided *P* value of less than .05 was considered significant. We entered variables with a *P* value of less than 0.1 in univariate testing into a multivariate logistic regression model. The study was approved by the Washington University Human Research Protection Office.

One hundred eighty-three patients had hospital-acquired *E. coli* bacteriuria during the study period and met study criteria. Patients received a diagnosis of ASB (77 patients; 42%), cystitis (28 patients; 15%), pyelonephritis (55 patients;

30%), or unclassifiable bacteriuria (e.g., bacteriuria diagnosed in intubated patients; 23 patients; 13%). Among asymptomatic patients, 65 (84%) were female.

Eighty-five of 183 episodes (46%; 95% confidence interval, 37%–56%) were catheter associated. Patients with catheter-associated bacteriuria were more likely to be male (*P* = .003), to have renal insufficiency (*P* = .02), and to have undergone a recent urological procedure (*P* = .03; Table 1). There was no difference in the prevalence of ASB (*P* = .6).

One hundred fifty-one patients with bacteriuria (83%) received antibiotic treatment, including 64 (83%) of the patients with ASB. The presence of a catheter did not determine whether antibiotics matched susceptibilities (70 [99%] of 71 with catheter vs 77 [96%] of 80 without catheter; *P* = .6). Among those patients tested for bacteremia, there was no difference in the frequency of bacteremia (*P* = .5). In-hospital mortality was similar among those with catheter-associated bacteriuria and those with non-catheter-associated bacteriuria (*P* > .99), as was the length of hospital stay after bacteriuria (*P* = .08). Independent factors predisposing to catheter-associated bacteriuria in bacteriuric patients are shown in Table 1.

It is widely assumed that the terms "hospital-acquired bacteriuria" and "catheter-associated bacteriuria" are synonymous. However, few data actually quantify urinary catheterization as a precursor of bacteriuria. The 1983 Centers for Disease Control and Prevention guidelines for prevention of catheter-associated UTI state that 66%–86% of episodes of hospital-acquired bacteriuria are secondary to urinary instrumentation.⁴ The corresponding reference does not explicitly provide this information.⁵ Also, to our knowledge, this statement has not been reevaluated over the past 3 decades. We found that only 46% of cases of hospital-acquired bacteriuria in a tertiary-care hospital were catheter associated, which is lower than was previously suspected. Why there was such a high proportion of noncatheterized patients with bacteriuria is unclear. Changes in genitourinary hygiene during hospitalization may play a role, as could medications that alter the bladder function. It is possible that hospital policies to reduce unnecessary device use resulted in a lower proportion of catheter-associated bacteriuria. The development of targeted preventive measures clearly depends on a better understanding of the pathogenesis of non-catheter-associated nosocomial bacteriuria.

In noncatheterized patients, ASB may have been present before hospital admission but remained undetected until later in the hospital course, leading to patients being mislabeled as having nosocomial bacteriuria. Testing this hypothesis would require that admission urine samples for culture be obtained from patients. Antibiotic treatment of ASB was common (occurring in 83% of cases), independent of catheter status. Although ASB-related antibiotic overuse in long-term care fa-

TABLE 1. Comparison of Patients with Catheter-Associated and Non-Catheter-Associated Hospital-Acquired *Escherichia coli* Bacteriuria

Variable	Total (n = 183)	Catheter-associated (n = 85)	Non-catheter-associated (n = 98)	P	OR (95% CI)
Male sex	46 (25)	30 (35)	16 (16)	.003	2.8 (1.4–5.7)
White race	124 (68)	60 (71)	64 (65)	.4	...
Age, median years (range)	70 (20–98)	68 (24–96)	71 (20–98)	.9	...
Body mass index, median index (range)	27.1 (12.1–64.2)	27.0 (17.2–64.2)	27.3 (12.1–63.1)	.7	...
Charlson comorbidity score, median score (range)	3 (0–13)	3 (0–13)	3 (0–11)	.4	...
Diabetes mellitus	64 (35)	31 (37)	33 (34)	.7	...
Renal insufficiency (Cr level >1.5 mg/dL)	42 (23)	26 (31)	16 (16)	.02	2.2 (1.0–4.6)
Any malignancy	50 (27)	26 (31)	24 (25)	.4	...
Dementia	32 (18)	10 (12)	22 (22)	.06	0.5 (0.2–1.2)
Benign prostatic hyperplasia	12 (7)	8 (9)	4 (4)	.1	...
Urological procedure during current hospitalization	8 (4)	7 (8)	1 (1)	.03	10.4 (1.2–88.8)
Fever	52 (28)	23 (27)	29 (30)	.7	...
Confusion or altered mental status	47 (26)	23 (27)	24 (25)	.7	...
Sepsis	98 (54)	47 (55)	51 (52)	.7	...
Pyelonephritis	55 (30)	25 (29)	30 (31)	.9	...
Asymptomatic bacteriuria	77 (42)	34 (40)	43 (44)	.6	...
Urinalysis results >10 WBC/hpf	121 (66)	61 (72)	60 (61)	.1	...
Outcome					
Bacteremia	9/70 (13)	3/33 (9)	6/37 (16)	.5	...
Length of hospital stay after bacteriuria, median days (range)	4.9 (0.1–66.1)	5.6 (0.2–36.5)	4.2 (0.1–66.1)	.08	...
In-hospital mortality	13 (7)	6 (7)	7 (7)	>.99	...

NOTE. Data are no. (%) of patients unless otherwise specified. Hosmer-Lemeshow goodness-of-fit $P = .635$ (for the multivariate logistic regression model). Body mass index was calculated as the weight in kilograms divided by the square of height in meters. CI, confidence interval; Cr, creatinine; hpf, high-power field; OR, odds ratio; WBC, white blood cell.

cilities has stimulated interventions,⁶ comparable data for acute-care hospitals are lacking. ASB may be a major driver of antibiotic use (and antimicrobial resistance) in hospitals and therefore represents a target for antimicrobial stewardship.⁷

We identified a number of plausible independent predictors of catheter-associated bacteriuria. The lower prevalence of catheter-associated bacteriuria among bacteriuric women could be in line with their predisposition to ASB.⁸ The need for monitoring fluid intake and output may contribute to a higher frequency of catheterization among bacteriuric patients with renal insufficiency. Finally, catheters have been shown to result in postprocedure UTIs.⁹

Our data were obtained from medical records, including both physicians' and nurses' notes. It is possible that some urinary catheterizations were unrecorded, which may have led us to underestimate the number of catheter-associated bacteriurias. The imperfect correlation between catheterization and its documentation has been addressed in a recent study.¹⁰ Also, the proportion of catheter-associated episodes might be higher for nosocomial pathogens other than *E. coli*.

In summary, we found catheter-associated infection to be less common among cases of nosocomial *E. coli* bacteriuria than has been previously reported. A better understanding of non-catheter-associated bacteriuria could lead to improved infection-prevention strategies among hospitalized patients.

ACKNOWLEDGMENTS

We thank Cherie Hill and Dorothy Sinclair for their invaluable help with data management.

Financial support. This study was supported by the National Institutes of Health (NIH)—National Center for Research Resources, a component of the NIH (grant UL1 RR024992, sub-award KL2 RR024994); NIH Roadmap for Medical Research, KL2 Career Development Award (5KL2RR024994-03 to J.M.); Career Award for Medical Scientists from the Burroughs Wellcome Fund (to J.P.H.); NIH grant K12 HD001459-09 (to J.P.H.); and a Centers for Disease Control and Prevention (CDC) Epicenter Program grant (CDC 1U1CI000033 301 to D.K.W.).

Potential conflicts of interest. D.K.W. is a consultant for 3M Healthcare, C. R. Bard, and Cardinal Health and receives research funding from Sage Products, Cubist Pharmaceuticals, and bioMérieux. All other authors report no conflicts of interest relevant to this article.

**Jonas Marschall, MD;¹ Kyle N. Ota, MPH;¹
Jeffrey P. Henderson, MD, PhD;¹
David K. Warren, MD, MPH¹
for the Centers for Disease Control and Prevention
Epicenters Program**

Affiliations: 1. Division of Infectious Diseases, Washington University School of Medicine, St. Louis, Missouri.

Address correspondence to Jonas Marschall, MD, Division of Infectious Diseases, Washington University School of Medicine, 660 South Euclid, St. Louis, MO 63110 (jmarscha@dom.wustl.edu).

Received June 28, 2011; accepted July 13, 2011; electronically published October 6, 2011.

The contents are solely the responsibility of the authors and do not necessarily represent the official view of the National Center for Research Resources or the National Institutes of Health.

Infect Control Hosp Epidemiol 2011;32(11):1140-1142

© 2011 by The Society for Healthcare Epidemiology of America. All rights reserved. 0899-823X/2011/3211-0017\$15.00. DOI: 10.1086/662587

REFERENCES

- Hooton TM, Bradley SF, Cardenas DD, et al. Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. *Clin Infect Dis* 2009;50(5):625–663.
- Nicolle LE. The prevention of hospital-acquired urinary tract infection. *Clin Infect Dis* 2008;46(2):251–253.
- Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton TM. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. *Clin Infect Dis* 2005;40(5):643–654.
- Wong ES. Guideline for prevention of catheter-associated urinary tract infections. *Am J Infect Control* 1983;11(1):28–36.
- Martin CM, Bookrajian EN. Bacteriuria prevention after indwelling urinary catheterization: a controlled study. *Arch Intern Med* 1962;110:703–711.
- Zabarsky TF, Sethi AK, Donskey CJ. Sustained reduction in inappropriate treatment of asymptomatic bacteriuria in a long-term care facility through an educational intervention. *Am J Infect Control* 2008;36(7):476–480.
- Gross PA, Patel B. Reducing antibiotic overuse: a call for a national performance measure for not treating asymptomatic bacteriuria. *Clin Infect Dis* 2007;45(10):1335–1337.
- Colgan R, Nicolle LE, McGlone A, Hooton TM. Asymptomatic bacteriuria in adults. *Am Fam Physician* 2006;74(6):985–990.
- Wells TH, Steed H, Capstick V, Schepanksy A, Hiltz M, Faught W. Suprapubic or urethral catheter: what is the optimal method of bladder drainage after radical hysterectomy? *J Obstet Gynaecol Can* 2008;30(11):1034–1038.
- Meddings J, Saint S, McMahon LF Jr. Hospital-acquired catheter-associated urinary tract infection: documentation and coding issues may reduce financial impact of Medicare's new payment policy. *Infect Control Hosp Epidemiol* 2010;31(6):627–633.