Published in final edited form as:

Infect Control Hosp Epidemiol. 2009 April ; 30(4): 396–397. doi:10.1086/596044.

Role of Urine Sample Assessment in Identifying Colonization with Fluoroquinolone-Susceptible and Fluoroquinolone-Resistant *Escherichia coli*

Ebbing Lautenbach, MD, MPH, MSCE^{(1),(4)}, Andrew Babson⁽⁵⁾, Evelyn Santana⁽⁵⁾, Pam Tolomeo, MPH, CCRP⁽³⁾, Nicole Black, CCRP⁽³⁾, Catherine A. Smith⁽³⁾, and Joel Maslow, MD, PhD^{(1),(5)}

⁽¹⁾Division of Infectious Diseases of the Department of Medicine, University of Pennsylvania School of Medicine, Philadelphia, PA

⁽²⁾Division of Infectious Diseases of the Department of Biostatistics and Epidemiology, University of Pennsylvania School of Medicine, Philadelphia, PA

⁽³⁾Division of Infectious Diseases of the Center for Clinical Epidemiology and Biostatistics, University of Pennsylvania School of Medicine, Philadelphia, PA

⁽⁴⁾Division of Infectious Diseases of the Center for Education and Research on Therapeutics, University of Pennsylvania School of Medicine, Philadelphia, PA

⁽⁵⁾Section of Infectious Diseases, Department of Veterans Affairs, Philadelphia, PA

Keywords

Fluoroquinolone; resistant; *E. coli*; urine

INTRODUCTION

Efforts to elucidate the epidemiology of antimicrobial resistance among gram-negative bacteria have increasingly focused on the role of gastrointestinal (GI) tract colonization [1]. Sampling of GI flora (usually employing a peri-rectal swab approach) is increasingly common both for infection control initiatives and as a component of epidemiologic studies [2,3] with considerable time and effort dedicated to optimizing methodology to identify patients colonized with the organism of interest. The relationship between colonization in the GI tract and colonization in the urinary tract remains understudied [4,5]. In populations such as long term care facility (LTCF) residents, in which bacteriuria is common [6], sampling the urine in addition to the stool may potentially provide added information regarding colonization. However, no study has to date investigated whether there is added benefit to sampling both urine and stool to detect colonization with gram-negative bacteria.

Focusing specifically on identifying colonization with fluoroquinolone-susceptible *E. coli* (FQSEC) and/or fluoroquinolone-resistant *E. coli* (FQREC), the purpose of this study was to assess the added benefit of sampling urine in additional to fecal specimens.

Address correspondence to: Ebbing Lautenbach, M.D., M.P.H., M.S.C.E., University of Pennsylvania School of Medicine, Center for Clinical Epidemiology and Biostatistics, 825 Blockley Hall, 423 Guardian Drive, Philadelphia, PA 19104-6021, Telephone: (215) 898-6977, Fax: (215) 573-5315, Email: E-mail: ebbing@mail.med.upenn.edu.

All other authors report no conflicts.

METHODS

This study was performed at two LTCFs within the University of Pennsylvania Health System: 1) Penn Center for Rehabilitation and Care (124 beds); and 2) Philadelphia Veteran's Administration (VA) Nursing Home (240 beds). This study was approved by the Institutional Review Boards of the University of Pennsylvania and the Philadelphia VA Medical Center.

This study was conducted as part of a larger ongoing investigation in which peri-rectal swabs are obtained every two weeks to assess longitudinal colonization with FQREC and FQSEC. All residents of the participating LTCFs were eligible to enroll in the study. For subjects agreeing and able to provide a urine specimen, a urine sample was collected as close to the time of the regularly scheduled peri-rectal swab sample collection.

Peri-rectal swabs were inoculated onto MacConkey agar, MacConkey agar with 0.25ug/ml of levofloxacin, and MacConkey agar with 8.0 µg/ml of levofloxacin. *E. coli* isolates with a minimum inhibitory concentration (MIC) to levofloxacin of >0.25 ug/ml were considered FQREC. Resistance was confirmed by e-strip. Recent data suggest that fecal samples demonstrating FQREC often harbor multiple strains of FQREC and/or FQSEC [7]. As such, from each rectal swab, six colonies each of FQREC and FQSEC were chosen for a maximum of 12 colonies [7]. Similarly, from urine samples yielding *E. coli*, six colonies each of FQSEC and FQREC as available (i.e., up to 12 total colonies) were randomly selected. Identification of *E. coli* in urine cultures was performed according to criteria of the Clinical and Laboratory Standards Institute (CLSI) [8].

Genetic relatedness of isolates was determined by pulsed field gel electrophoresis (PFGE) as described [9] and interpreted according to established criteria [10]. Strains identified in the urine were compared to those isolated from the stool. For subjects with samples ≥4 days between the urine and the temporally closest peri-rectal swab sample, the peri-rectal swabs both before and after the urine sample were compared.

RESULTS

There were 56 paired peri-rectal swab and urine samples including 52 unique subjects and four subjects with two paired samples. For the latter four patients, paired samples were separated in time by a median of 4.5 months. Of the 52 unique subjects, the median age was 77 (interquartile range 64-84) and 42 (81%) subjects were male. Twenty-three subjects were African-American, 24 subjects were White, and five were classified as "other". No patient was diagnosed with a urinary tract infection during the course of this study.

Of the 56 paired samples, 31 (55%) had *E. coli* identified in the peri-rectal swab while six (11%) had *E. coli* identified in the urine. In all cases of a positive urine sample, concurrent peri-rectal swabs also yielded *E. coli*. All urine samples yielded a single strain of *E. coli* by PFGE criteria: three FQSEC and three FQREC. A single strain was detected from five of six concurrent stool samples; one stool sample yielded two strains (one FQREC and one FQSEC). In all cases, the stool yielded a strain of the same susceptibility pattern as the matching urine sample. When examining *E. coli* at the level of the strain by PFGE, three paired samples had the same strain identified in the urine and peri-rectal swab (FQREC on two occasions and FQSEC on one occasion), while three subjects had distinct strains identified. For the three patients with unique urinary strains, subsequent peri-rectal swab samples were examined and in no case was the urinary strain identified from a rectal swab.

DISCUSSION

We found that when the goal is to identify the presence of FQSEC and/or FQREC colonization, sampling the urine does not add to the ability to identify colonized subjects. Moreover the significance of the rare finding of unique strains of *E. coli* identified in urine samples is unclear since no patient had evidence of clinical infection, and these strains appeared to be transient and not detected in subsequent stool samples. While sampling of the urine may provide a greater measure of the total exposure of patients to colonizing strains of *E. coli*, our data suggest that unique strains detected solely in the urinary samples may be transient colonizers since none were detected in subsequent peri-rectal swab samples. Whether or not the added effort of urine sampling is warranted will depend primarily on the goals of the initiative or study.

ACKNOWLEDGEMENTS

This work was supported by the Public Health Service grant R01-AG023792 of the National Institute on Aging (NIH) (Dr. Lautenbach).

This study was also supported in part by an Agency for Healthcare Research and Quality (AHRQ) Centers for Education and Research on Therapeutics cooperative agreement (U18-HS10399).

Dr. Lautenbach has received research support from Merck, Ortho-McNeil, and AstraZeneca Pharmaceuticals. Dr. Maslow has received research support from Merck Pharmaceuticals.

REFERENCES

1. Donskey CJ. The role of the intestinal tract as a reservoir and source for transmission of nosocomial pathogens. *Clin Infect Dis* 2004;39:219–26. [PubMed: 15307031]
2. Lautenbach E, Harris AD, Perencevich EN, Nachamkin I, Tolomeo P, Metlay JP. Test characteristics of perirectal and rectal swab compared to stool sample for detection of fluoroquinolone-resistant *Escherichia coli* in the gastrointestinal tract. *Antimicrob Agents Chemother* 2005;49:798–800. [PubMed: 15673772]
3. Carratala J, Fernandez-Sevilla A, Tubau F, Dominguez MA, Gudiol F. Emergence of fluoroquinolone-resistant *Escherichia coli* in fecal flora of cancer patients receiving norfloxacin prophylaxis. *Antimicrob Agents Chemother* 1996;40:503–5. [PubMed: 8834911]
4. Arbeit RD, Arthur M, Dunn R, Kim C, Selander RK, Goldstein R. Resolution of recent evolutionary divergence among *Escherichia coli* from related lineages: the application of pulsed field electrophoresis to molecular epidemiology. *J Infect Dis* 1990;161:230–5. [PubMed: 1967621]
5. Brumfitt W. Progress in understanding urinary infections. *J Antimicrob Chemother* 1991;27:9–22. [PubMed: 2050598]
6. Nicolle LE. Urinary tract infection in long-term-care facility residents. *Clin Infect Dis* 2000;31:757–61. [PubMed: 11017826]
7. Maslow JN, Lee B, Lautenbach E. Fluoroquinolone-resistant *Escherichia coli* carriage in long-term care facility. *Emerg Inf Dis* 2005;11:889–94.
8. National Committee for Clinical Laboratory Standards (NCCLS). Performance standards for antimicrobial susceptibility testing. NCCLS approved standard M100-S11. National Committee for Clinical Laboratory Standards; Wayne, PA: 2001.
9. Maslow JN, Mulligan ME, Arbeit RD. Molecular epidemiology: application of contemporary techniques to the typing of microorganisms. *Clin Infect Dis* 1993;17:153–62. [PubMed: 8399860]
10. Tenover FC, Arbeit RD, Goering RV, et al. Interpreting chromosomal DNA restriction patterns produced by pulsed-field gel electrophoresis: criteria for bacterial strain typing. *J Clin Microbiol* 1995;33:2233–9. [PubMed: 7494007]