RESEARCH BRIEFS

Sites of Colonization with Extended-Spectrum β-Lactamases (ESBL)–Producing Enterobacteriaceae: The Rationale for Screening

Extended-spectrum β-lactamases (ESBL)–producing organisms have emerged as one of the most important multiresistant pathogens in hospitals.[1] They are spreading in the community worldwide, mainly causing urinary tract infections.[2] Infections caused by ESBL-producing organisms are associated with poor outcomes, reduced rates of clinical response, longer hospital stays, and greater expenses.[3] Authorities at the Centers for Disease Control and Prevention (CDC) recommend performance of active surveillance cultures from patients in populations at risk, for example, patients in intensive care, burn, bone marrow or stem cell transplant, and oncology units, patients transferred from facilities known to have high prevalence rates, roommates of colonized or infected persons, and patients known to have been previously infected or colonized.[4] Despite the CDC's recommendation, standardized screening schemes for carriage of multiresistant gram-negative pathogens, including ESBL-producing Enterobacteriaceae, are lacking. Knowledge of the body sites most commonly colonized with these pathogens is of great importance to inform appropriate and cost-effective screening procedure policies. The aim of this study, therefore, was to determine the frequency of colonization for each body site.

University Hospital Basel is an 855-bed tertiary care center with 5 intensive care units (ICUs). The study was approved by the local ethics committee as part of the quality assurance program. From January 2008 to December 2010, all consecutive adult patients in whom an ESBL-producing Enterobacteriaceae was detected in any clinical specimen routinely taken for suspected infection were included in the study. Patients were screened for colonization by examination of urine samples and rectal, inguinal, and throat swabs. Specimens were cultured onto the chromogenic BBL CHROMagar Orientation medium (Becton Dickinson) or chromID ESBL medium (bioMérieux). No screening was performed if patients were receiving antibiotics active against ESBL-producing Enterobacteriaceae, as this may have led to false-negative screening results. Patients who did not receive screening of all 4 body sites (urine, rectum, groin, and throat) were excluded.

For microbiological detection of ESBL producers, the guidelines of the Clinical and Laboratory Standards Institute were followed.[5] The frequency of detection was calculated for each site. The proportion of CTX-M genotype was determined by polymerase chain reaction using the degenerative oligonucleotides CTX-F2 (5′-GTGCAGYACCAGTAARGTKATGG-3′) and CTX-M-R1 (5′-CDCMGCT GCCGGTYTTATC-3′).[6,7] Sequencing of amplicons was performed with an ABI 3130 Genetic Analyzer (Applied Biosystems). ESBL-producing strains were detected in 204 patients, of whom 133 (65.2%) had all 4 sites swabbed and 58 (28.4%) did not undergo swabbing because they were under treatment with a systemic antibiotic with activity against ESBL-producing pathogens or had already been discharged or transferred to another hospital. The remaining 13 patients (6.4%) were swabbed in 1 or 2 of the 4 sites but not in all 4 because of noncompliance with written instructions. Of the 133 patients swabbed at all 4 sites, 60 (45.1%) were hospitalized on the medical wards, 44 (33.1%) on the general surgical wards, 17 (12.8%) on the gynecology department, 8 (6.0%) on the urology department, 2 (1.5%) on the neurology department, and 2 (1.5%) on the bone marrow transplant unit. Patients' median age was 66 years (range, 18–93), with a female predominance of 60.2% (80/133 patients).

Escherichia coli accounted for the majority of all ESBL-producing Enterobacteriaceae (85.7%, 114/133), followed by *Klebsiella pneumoniae* (13.5%, 18/133) and *Citrobacter freundii* (0.8%, 1/133). The CTX-M genotype was detected in 109 of 133 patients (82.0%), accounting for 85.1% (97/114) of all ESBL-producing *E. coli* and 66.7% (12/18) of ESBL-producing *K. pneumoniae* isolates.

ESBL-producing Enterobacteriaceae were most commonly recovered from urine samples, which were positive in 82.7% (110/133) of patients, followed by rectal swabs (69.2%, 92/133), skin swabs of the groin (35.3%, 47/133), and throat swabs (12.8%, 17/133; Table 1).

Urine and the rectum were most commonly colonized with ESBL-producing Enterobacteriaceae (82.7% and 69.2%, respectively). Our finding that urine was the only positive screening site in 24.1% of our patients provides strong evidence that urine samples should be included in a standardized screening regimen.

The CDC recommends performance of active surveillance cultures for patients from populations at risk,[4] as patients colonized with ESBL-producing Enterobacteriaceae are at increased risk to develop invasive infections with these pathogens. A 5-fold increased risk for invasive infection with an ESBL-producing Enterobacteriaceae for ICU patients with rectal colonization has been described,[8] and Reddy et al[9] found that 8.5% of patients colonized with ESBL-producing Enterobacteriaceae developed subsequent bloodstream infections with these pathogens. The authors therefore concluded that active surveillance for ESBL-producing Enterobacteriaceae may have important clinical implications for empiric treatment of febrile episodes. In these 2 studies, however, screening for colonization was performed only by collection of rectal swabs. More than 20% of ESBL-positive patients may remain undetected with this approach, which does not include screening of the urine.

TABLE 1. Overview of the Different Colonization Patterns Detected in 133 Patients

Pattern	No. of patients (%)
1 colonization site	
Urine	32 (24.1)
Rectum	11 (8.3)
Groin	1 (0.7)
Throat	1 (0.7)
2 colonization sites	
Urine, rectum	38 (28.6)
Urine, groin	5 (3.8)
Urine, throat	1 (0.7)
Rectum, groin	6 (4.6)
Rectum, throat	1 (0.7)
Groin, throat	0 (0.0)
3 colonization sites	
Urine, rectum, groin	23 (17.3)
Urine, rectum, throat	2 (1.5)
Urine, groin, throat	1 (0.7)
Rectum, groin, throat	3 (2.3)
4 colonization sites	
Urine, rectum, groin, throat	8 (6.0)
Site totals	
Patients with colonization of the urine	110 (82.7)
Patients with colonization of the rectum	92 (69.2)
Patients with colonization of the groin	47 (35.3)
Patients with colonization of the throat	17 (12.8)

The high percentage of the CTX-M genotype of ESBL-producing Enterobacteriaceae detected in our study reflects the worldwide trend of the spread of these multiresistant pathogens to the community.[10] Future screening strategies may have to take this expanding epidemiology into account.

Important limitations of our study are its observational design, its being conducted at a single center, and the small sample size, limiting generalizability. Only hospitalized patients with detection of ESBLs in any clinical specimen routinely taken for suspected infection and not receiving antibiotics active against ESBL-producing Enterobacteriaceae at the time of swabbing were included, so the results cannot necessarily be extrapolated to an outpatient setting or to healthy individuals.

We conclude that a standardized screening regimen for ESBL-producing Enterobacteriaceae should include both urine samples and rectal swabs.

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