Journal of Infection and Public Health (2009) **2**, 129—135

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Prevalence of extended-spectrum beta-lactamase-producing Enterobacteriaceae in Bahrain

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Received 19 March 2009; received in revised form 21 April 2009; accepted 28 April 2009

KEYWORDS
ESBL;
Bahrain

Summary
Objectives: To determine the occurrence of extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae in Bahrain.
Methods: Retrospective analysis of records (January 2005—December 2006) at the Microbiology Laboratory of the Salmaniya Medical Complex, Bahrain which is the major national diagnostic laboratory.
Results: Out of a total of 11,886 member of family of Enterobacteriaceae isolated, 2695 (22.6%) were ESBL producers. Majority of ESBL isolates were from inpatients ($n = 2363$; 87.7%). *Escherichia coli* (52.2%) and *Klebsiella pneumoniae* (24.3%) were predominant and distributed comparatively in the hospital wards while *Proteus* spp. (17.6%) was predominant in medical wards. Urine was the major source (52.2%) with low occurrence in blood cultures. No carbapenem resistant isolates was identified but resistance to three classes of antibiotics was exhibited by >25% of the isolated ESBL strains. Nitrofurantoin resistance was identified in 38.2% of urinary isolates.
Conclusion: This is the first report from Bahrain and it indicates that the prevalence of ESBL-producing isolates is high. Carbapenems were the most active drug against the ESBL-producing isolates. We recommend strict infection control to prevent trafficking into the community.

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doi:10.1016/j.jiph.2009.04.005

Introduction

Globally there is a continuing upward trend in the prevalence of pathogens producing extended-spectrum beta-lactamases (ESBLs). As infections caused by these ESBL-producing organisms are associated with higher rates of mortality, morbidity as well as health care costs. This upward trend is of concern to health care providers. ESBL arises as a result of mutations in the TEM-1, TEM-2 or SHV-1 genes which are commonly found in the Enterobacteriaceae family [1]. Others enzymes, notably members of the cefotaxime resistance family (CTX-M), represent plasmid acquisition of broad-spectrum beta-lactamases originally determined by chromosomal genes. These mutations result in alterations in the amino acid configuration thus conferring on these enzymes the ability to hydrolyze a broader spectrum of beta-lactam antibiotics including penicillins, oxyimino-cephalosporins and monobactams. However these plasmid-mediated enzymes have no detectable activity against cephamycins or the carbapenems (imipenem and meropenem). They are also generally susceptible to beta-lactamase inhibitors, such as clavulanate, sulbactam, and tazobactam These ESBLs are most commonly identified in Gram-negative organisms, primarily in *Klebsiella pneumoniae*, *Klebsiella oxytoca*, and *Escherichia coli* but they have also been described in *Acinetobacter*, *Burkholderia*, *Citrobacter*, *Enterobacter*, *Morganella*, *Proteus*, *Pseudomonas*, *Salmonella*, *Serratia*, and *Shigella* spp. [2].

Since the 1983 report of the first outbreak involving ESBL-producing organisms in Germany, other reports from Europe, the USA and the Far East have confirmed the role of ESBL-producing organisms as important agents in nosocomial infections [1,3]. In recent years, variants of the original ESBL enzymes such as CTX-M beta-lactamases have become widespread with an endemic situation now prevailing in Asia, South America and parts of Europe [4—6]. As evidence indicates regional/national diversity in the prevalence of ESBL isolates there is a need for continued surveillance. Up to date, there have been no reports documenting the prevalence of ESBL isolates in the Kingdom of Bahrain. However data from other countries within the Arabian Gulf region suggest ESBL isolates constitute a major problem in nosocomial and community acquired infections with rates ranging from 7.5% to 31.7% reported in Kuwait to the highest of 41% which we have recently shown in data from United Arab Emirates [7—9]. In this report, we present the first data on ESBL-producing isolates identified in the Kingdom of Bahrain.

Materials and methods

Setting

The Kingdom of Bahrain is a group of small islands located in the Arabian Gulf region with a population of approximately 650,000. The Salmaniya Medical Complex (SMC) is a 1000-bed hospital that serves as a secondary and tertiary referral center for specialist care, laboratory diagnosis and admissions. The microbiology laboratory processes specimens for inpatients as well as outpatients seen at SMC clinics and primary health care facilities.

Data collection

Retrospective analysis of laboratory records at SMC over a 2-year period from January 2005 to December 2006 was carried out to identify ESBL-producing isolates detected during the study period. Only one positive culture per patient was included hence repeated positive cultures from the same patient were excluded from the analysis. Data on patient demographics, specimen source (inpatient or outpatient), specimen type as well as the antibiotic susceptibility profile of the isolates were recorded.

Detection of ESBL isolates

During the study period, bacterial identification, screening for ESBL and antimicrobial susceptibility testing were performed with the BD Phoenix™ (Becton Dickinson Diagnostic Systems, MD, USA) Automated Microbiology system which incorporates the BDXpert system. Specifically for ESBL detection, the Phoenix™ ESBL test used fixed concentrations of the following drugs or drug combinations: cefpodoxime, ceftazidime, ceftazidime plus clavulanic acid (CA), cefotaxime plus CA, and ceftriaxone plus CA. The isolates were subcultured on MacConkey agar to obtain a pure culture from which a 0.5 McFarland suspension was obtained and tested according to the manufacturer provided protocol. Confirmation of the ESBL phenotype was carried out using the double disc diffusion method. This was carried out using antibiotic discs containing a combination of cephalosporin plus clavulanic acid in conjunction with a corresponding cephalosporin disc alone and interpreted according to CLSI guidelines [10]. The following antibiotic discs were used: ceftazidime (CAZ 30 μg), ceftazidime plus clavulanic acid (CAZ/CA 30/10 μg), cefotaxime (CTX 30 μg) and cefotaxime plus clavulanic acid (CTX/CA 30/10 μg) and were all obtained from Becton Dickinson, USA. Briefly, isolates were subcultured on