Multidrug Resistant Organisms; Hospitalized and non Hospitalized Iranian Patients: Review Article

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ARTICLE INFO

Article history:
Received 23 August 2013
Received in revised form 24 September 2013
Accepted 29 September 2013
Available online 17 November 2013

Key words:
Multidrug Resistant Organisms,
Extended Spectrum Beta Lactamase,
Escherichia coli, Klebsiella pneumoniae

ABSTRACT

Multidrug resistant organisms that, have important infection control implications have received limited consideration in many countries including Iran previous isolation guidelines. Extended spectrum beta lactamases are a group of active-site serine enzymes that are able to hydrolyse a wide range of beta-lactams, including the most recently developed cephalosporins and monobactam. In this present study the prevalence of extended spectrum beta-lactamases (ESBL) producing Escherichia coli and Klebsiella pneumoniae in hospitalized and non hospitalized Iranian patients during the period of 2008 to 2011 was determined. Related papers on prevalence of extended spectrum beta lactamase in isolated E. coli and K. pneumoniae from hospitalized and non hospitalized patients were extracted from original and review articles published in Pubmed, Elsivier Science, and Yahoo during the period of 1995 to 2013. For this study “key words” which were search include “multidrug resistant organisms, extended spectrum beta lactamase, Escherichia coli and Klebsiella pneumoniae”. Comparing of ESBLs percentage showed that frequency of occurrence of ESBLs in E.coli and K. pneumoniae were highly in hospitalized patients compared to non hospitalized patients. Present results showed very higher ESBLs producing E.coli and K. pneumoniae prevalence in Iran province that alarm an emerging public-health concern and emphasize on emergence need for developing a treatment guideline for antibiotic consumption.

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INTRODUCTION

Antimicrobial resistance is one of the significant problems worldwide leads to curative failure of therapy and it has been a threat to the patient’s safety not only in developing countries but also in developed countries [3,14,16,35,21-23]. Therefore, awareness of the local prevalence of pathogens and their antimicrobial sensitivity patterns is essential for clinicians. Establishing surveillance systems integrate clinical and laboratory data and by it the necessary data can be captured and strengths of both data sets can be combined. There is evidence that the wiser use of antimicrobials may reduce the rate of resistance emerges [4,5,19,20,42,45]. Thus information from surveillance of antimicrobial resistance and data on the use of antimicrobials provides a powerful tool for the control of resistance. The aim of antimicrobial resistance surveillance is to provide information necessary to obtain an approach to the management of communicable diseases that diminishes morbidity and mortality[24,25]. The main applications of surveillance information are to optimize the use of antimicrobials and assist in the prevention and control of antimicrobial resistance at the local, national and international levels [42,45,46].

Multidrug-resistant organisms (MDROs), including methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant enterococci (VRE) and certain Gram-negative bacilli (GNB) have important infection control implications that either have not been addressed or received only limited consideration in previous isolation guidelines. Increasing experience with these organisms is improving understanding of the routes of transmission and effective preventive measures. For epidemiologic purposes, MDROs are defined as microorganisms, predominantly bacteria, that are resistant to one or more classes of antimicrobial agents. Although the names of certain MDROs describe resistance to only one agent (e.g., MRSA, VRE), these pathogens are frequently resistant to most available antimicrobial agents. These highly resistant organisms deserve special attention in healthcare facilities [41]. In addition to MRSA and VRE, certain GNB, including those producing extended spectrum beta-lactamases (ESBLs) and others that are resistant to multiple classes of antimicrobial agents, are of particular concern. In addition to Escherichia coli and Klebsiella pneumoniae, these include strains of Actinetobacter baumannii resistant to all antimicrobial agents, or all except imipenem and
organisms such as *Stenotrophomonas maltophilia*, *Burkholderia* and *Ralstonia pickettii* that are intrinsically resistant to the broadest-spectrum antimicrobial agents. In some residential settings (e.g., LTCFs), it is important to control multidrug-resistant [17-19,41].

Members of the family Enterobacteriaceae commonly express plasmid-encoded β-lactamases (e.g., TEM-1, TEM-2, and SHV-1), which confer resistance to penicillins but not to expanded-spectrum cephalosporins. ESBLs are beta-lactamases that hydrolyze extended-spectrum cephalosporins with an oxyimino side chain. These cephalosporins include cefotaxime, ceftriaxone, and ceftazidime, as well as the oxyimino-monobactam aztreonam. Thus ESBLs confer resistance to these antibiotics and related oxyimino-beta lactams [28,34,36]. Typically, they derive from genes for TEM-1, TEM-2, or SHV-1 by mutations that alter the amino acid configuration around the active site of these beta-lactamases. This extends the spectrum of beta-lactam antibiotics susceptible to hydrolysis by these enzymes [28,34,36]. An increasing number of ESBLs not of TEM or SHV lineage have recently been described [7]. The ESBLs are frequently plasmid encoded. Plasmids responsible for ESBL production frequently carry genes encoding resistance to other drug classes (for example, aminoglycosides). Therefore, antibiotic options in the treatment of ESBL-producing organisms are extremely limited. Carbapenems are the treatment of choice for serious infections due to ESBL-producing organisms, yet carbapenem-resistant isolates have recently been reported. ESBL-producing organisms may appear susceptible to some extended-spectrum cephalosporins. However, treatment with such antibiotics has been associated with high failure rates. While ESBL-producing organisms were previously associated with hospitals and institutional care, these organisms are now increasingly found in the community [26,27]. CTX-M-15-positive *E. coli* are a cause of community-acquired urinary infections in the UK and tend to be resistant to all oral beta-lactam antibiotics, as well as quinolones and sulfonamides. Treatment options may include nitrofurantoin, fosfomycin, mecillinam and chloramphenicol. In desperation, once-daily ertapenem or gentamicin injections may also be used. Although the inhibitor-resistant beta-lactamases are not ESBLs, they are often discussed with ESBLs because they are also derivatives of the classical TEM- or SHV-type enzymes. These enzymes were at first given the designation IRT for inhibitor-resistant TEM β-lactamase; however, all have subsequently been renamed with numerical TEM designations. There are at least 19 distinct inhibitor-resistant TEM β-lactamases. Inhibitor-resistant TEM β-lactamases have been found mainly in clinical isolates of *E. coli*, but also some strains of *K. pneumoniae*, *Klebsiella oxytoca*, *Proteus mirabilis*, and *Citrobacter freundii*. Although the inhibitor-resistant TEM variants are resistant to inhibition by clavulanic acid and sulbactam, thereby showing clinical resistance to the beta-lactam-lactamase inhibitor combinations of amoxicillin-clavulanate (Co-amoxiclav), ticarcillin-clavulanate, and ampicillin/sulbactam, they normally remain susceptible to inhibition by tazobactam and subsequently the combination of piperacillin/tazobactam, although resistance has been described. To date, these beta-lactamases have primarily been detected in France and a few other locations within Europe [4,30,38].

Extended spectrum beta lactamase (ESBL) production is one of the different mechanisms of drug resistance in Gram-negative bacilli predominantly present in *E. coli* and *K. pneumoniae* [2,6-8,31,32]. Infectious Diseases Society of America listed ESBL-producing *Klebsiella spp* and *E. coli* as one of the six drug-resistant microbes to which new therapies are urgently needed [28,29,44]. Author aimed to determine the prevalence of ESBL-producing *E.coli* and *K. pneumoniae* isolated from acquired urinary trace infection hospitalized and non hospitalized Iranian patients in from 2008 to 2011. Relater papers to prevalence of extended spectrum beta lactamase in isolated *E.coli*, *K. pneumoniae* from hospitalized and non hospitalized patients were extracted of original and review articles (Available freely to download) in Pubmed, Elsvier Science, and Yahoo from 1995 to 2013 years. For this study key words which were search include multidrug resistant organisms, extended spectrum beta lactamase, *E. coli* and *K.pneumoni* and IRAN.

**Discussion:**

Study and comparing of ESBLs percentage showed that frequency of occurrence of ESBLs in *E. coli* and *K. pneumonia* were higher in hospitalized patients in comparison to non hospitalized patients, for example in some study in Iran prevalence of ESBL in isolated *E.coli* and *K. pneumonia* from hospitalized and non hospitalized patients was 72.22%, 23.73% and 83.33% and 0%, respectively [11-16].

The rapid spread of ESBL-producing bacteria worldwide indicated needing of a continuous monitoring systems and effective infection control measures [4,35,42]. Comprehensive epidemiologic data and characterization of ESBL-producing isolates among hospitalized and non hospitalized in Iran are still rarely documented and previous studies failed in extend number of patients, long-term study and comprehensive epidemiologic data despite of their useful content leading to a global view on ESBL producing bacteria in Iran. For example, [1] determine the prevalence of extended spectrum beta-lactamase (ESBL) producing *E.coli* in one 900-bed general teaching hospital showed 56% (n=140) of *E. coli* isolates produced ESBLs from 3 university hospitals in Tehran during six months. Therefore, for first time we (Mobasherizadeh and et al) launched a prospective surveillance study of laboratory based antimicrobial resistance (Antimicrobial Resistance Surveillance System) in Isfahan province, Iran. In this surveillance study, the prevalence of ESBL producing *E.
coli in hospitalized and non hospitalized infections has been studied during three years (2008 to 2011) and WHONET software as an analysis program helping in forming hospital drug policy was used. (This WHONET is free Windows-based database software developed for the management and analysis of microbiology laboratory data with a special focus on the analysis of antimicrobial susceptibility test results). The prevalence of ESBL-producing E. coli under antimicrobial resistance surveillance system has been studied in several countries [5,32,37,39,40,43,45,46].

Establish systems for monitoring antimicrobial resistance in hospitals and the community and link these findings to resistance and disease surveillance data are fundamental to developing treatment guidelines accurately and to assessing the effectiveness of interventions appropriately. For first time launched (Mobasherizaded and et al) a prospective Antimicrobial Resistance Surveillance System in Iran. Present result showed very high prevalence of ESBL producing E.coli and K. pneumoniae in Iran province that alarm an emerging public-health concern, showed emergence need for developing a treatment guideline for antibiotic consumption. Continued surveillance will provide an important function for succeed in the efforts of infection control programs in future and it is a critical step for controlling of the growing worldwide threat of antimicrobial drug resistance [9,10].

REFERENCES


