Antimicrobial Resistance among Gram-Negative Bacteria Isolated from Different Samples of Patients Admitted to a University Hospital in Kashan, Iran

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Abstract: Antibiotic resistance is a complex dynamic problem, resulting in substantial morbidity, mortality and increasing cost of treatment. In this retrospective study, we examined Gram-negative bacterial resistance of imipenem, ceftazidime and cefepime in the samples sent to the laboratory of Shahid Beheshti Hospital in 2011-2012. Data of 1041 patients were included in our study. 50.8% patients were male and 49.2% were female. 79.3% of samples were urine, 5.6% were blood and 15.1% were from other origins. 71.9% of cultures were E. coli and 9.9% were Klebsiella and 18.2% were other organisms. Resistance rates of cefepime and ceftazidime were more than 50% in most of the organisms. Imipenem had high resistance rate, comparing to other studies, but less than 50% in most cases. Gram negative bacteria were dangerously resistant to 3 wide spectrum antibiotics evaluated in this study. Making new policies towards stopping the antibiotic resistance seems to be essential.

Key words: Antimicrobial · Bacteria · Resistance

INTRODUCTION

Admitting and treating infectious patients in hospitals is one of the most important medical concerns. Despite the great costs of antibiotics, many of the infectious diseases bring comorbidity and mortality to the patients. One of the most important causes of infection in hospitals is Gram-negative bacteria [1]. These bacteria are the cause of early and late onset neonatal sepsis that also have high mortality rate [2]. This mortality is increasing every day mainly because of global changing of antimicrobial resistance patterns [3-5]. The Gram-negative bacilli that were considered unusual in past, now account for 15-20% of meningitis causes in adults [6]. Antibiotic resistance is a complex dynamics problem, resulting in substantial morbidity, mortality and increasing cost of treatment [7-10]. This is resulted mainly from misuse and overuse of antibiotics, especially in developing countries [8]. A strong association between antibiotic use and resistance has been seen and it has been shown that in places like ICU with wide use of antibiotics, antibiotic resistance also increased [7]. Resistance among Gram-negative bacteria is a serious problem, especially in certain geographic areas [11]. Pseudomonas aeruginosa and Enterobacteriaceae family had shown high rates of antibiotic resistance [9, 12, 13]. There is an increasing rate of antibiotic resistance in hospitals. It is concerning because hospitals contain susceptible patients, like diabetic or old patients [3]. According to research that was conducted in South Africa 48.5% of the samples taken from the three hospitals showed antibiotic resistance [14].

Broad spectrum antibiotics were the last line of treatment that had high sensitivity, but in recent years, emerging of resistant species by production of new Extended-spectrum beta-lactamases (ESBLs), made a great concern [15]. Third, even forth generations of cephalosporin and other known effective Broad spectrum antibiotics, are now being threatened by antibiotic resistance [16].

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As the use of antibiotics such as imipenem, ceftazidime and cefepime in Iran in the treatment of Gram-negative infections increase every day and also there is a lack of access to accurate information on regional sensitivity pattern of these antibiotics, we decided to examine Gram-negative bacterial resistance of antibiotics such as imipenem, ceftazidime and cefepime in the specimens sent to the laboratory of Shahid Beheshti Hospital in 2011-2012.

MATERIALS AND METHODS

This study was approved by Kashan University of Medical Sciences Ethical Committee. In this retrospective study, by referring to the Shahid Beheshti Hospital laboratory, cultures of Gram-negative bacteria isolated from different samples of patients admitted to the hospital from 1st December 2011 to 1st December 2012, were identified [1]. Sex, age, type of specimen and antibiotic susceptibility of every case has been added to checklists and all data were analyzed with SPSS software version 11.5. Names of the patients remained unrevealed. Antimicrobial susceptibility was evaluated by the Kirby-Bauer disk diffusion method in guidelines of Clinical and Laboratory Standards Institute [17].

RESULTS

Data of 1041 samples were analyzed. Each patient had only one specimen. Mean age of patients were 42.3 years. 529 (50.8%) patients were male and 512 (49.2%) were female. 826 (79.3%) of specimens were urine, 58 (5.6%) were blood and 157 (15.1%) were from other origins (Fig. 1). 748 (71.9%) of cultures were E. coli and 103 (9.9%) were Klebsiella and 190 (18.2%) were other organisms (Fig. 2). Antibiotic susceptibility of the cultures to cefepime, ceftazidime and imipenem were shown in Figs. 3-5.
DISCUSSION

Extensive use of broad-spectrum antibiotics may cause selective pressure and making multi drug resistant strains [18]. This study was conducted on 1041 samples. Obtained information about the susceptibility of E. coli bacteria for cefepime showed that 39.9 percent of E. coli cultures are sensitive, 5.26% are intermediate and 54% are resistant. In a study on 453,000 isolates at the University Of Geneva Hospitals, Switzerland, Vernaz et al [19] published the resistance rate of E. coli bacteria to cefepime from 2000 to 2007 as 1.9, 1.39, 1.37, 0.92, 1.44, 2.11, 2.51 and 3.22% in each year respectively [19]. Cefepime resistance of Enterobacteriaceae has increased in recent years. This increase shows the prevalence of ESBL-producing Enterobacteriaceae in each region [20]. 53.1% rate of cefepime resistance is much higher than rates in other studies.

Our results indicated that 48% of pseudomonas and 37% of acinetobacter are resistant to cefepime. Jazani et al. [18] in Urumieh, Iran found 75.4% of pseudomonas and Günsarena et al. [20] in Ankara, Turkey found 68.6% of pseudomonas and 88.8% of acinetobacter are resistance to cefepime. Our results showed lower resistance of pseudomonas and acinetobacter to cefepime, maybe because this antibiotic is not overusing in Kashan, Iran as in Ankara and Urumieh. Comparing to our study, other studies mainly showed lower levels of antibiotic resistance [20-28]. Levels of E. coli resistance to ceftazidime in our study was 55.9%. Ramon et al [29] conducted a study to measure antibiotic resistance in different years. In 1998 out of 76 samples, 18 (23%), in 2003, out of the 104 samples, 28 (26%) and in 2008 out of 102 samples of E. coli positive cultures, 23 (22%) were resistant to ceftazidime. These figures are much lower than the results in our study. Levels of pseudomonas, klebsiella and proteus resistance to ceftazidime in our study were also high, comparing to Baron et al study.

Gram negative bacteria were dangerously resistant to 3 wide spectrum antibiotics evaluated in this study. Some resistance rates were more than 50% making these antibiotics practically ineffective towards some organisms. It is recommended to do an annual survey on antibiotic resistance in shahid beheshti hospital and make firm policies toward restriction of prescribing some sensitive antibiotics. Prescribing the antibiotics based on culture and sensitivity results may play a key role in controlling antibiotic resistance.

REFERENCES


