



Research Article

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The pattern of antibiotic sensitivity of gram-negative MDR bacteria in patients admitted to the ICU

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Abstract

Due to the uncontrolled increase in the administration of antibiotics, the prevalence of multidrug-resistant organisms in patients admitted to intensive care units has also increased. Thus, this study aimed to investigate the pattern of sensitivity and compliance of treatment with the results of culture in gram-negative MDR bacteria in patients admitted to the intensive care unit of Shahid Sadoughi Hospital in Yazd. This cross-sectional study was performed over a period of one year on the results of culture of patients admitted to the intensive care unit of Shahid Sadoughi Hospital in Yazd (2020). The samples included blood, urine, wounds, bronchoalveolar lavage, shunt, and throat. All patient information and antibiotics prescribed were obtained using their records. Finally, the data was entered into SPSS (v. 26) and analyzed. In total, out of 298 patients for whom initial antibiotics were started experimentally, 226 cases had the culture results consistent with one of the antibiotics that were started initially. Among the antibiotics that were used more, clindamycin showed the least agreement with antibiotic sensitivity results. Among antibiotics, clindamycin had significantly the most compatibility in blood and urine and the least compatibility in wound. The present study showed a relatively good agreement in the initial experimental administration of antibiotics.

Keywords: Gram-negative, MDR, Antibiotic.

INTRODUCTION

Antibiotic resistance is a serious problem in all parts of the world ^[1]. Excessive use of antibiotics has led to the creation of resistant bacterial strains ^[2,3]. Multidrug-resistant (MDR) bacteria refer to microorganisms that are resistant to at least 3 or more antibiotics ^[4]. Multidrug resistance is commonly seen in gram-negative bacilli, which will have important clinical consequences due to the spread of these bacteria and the treatment options available to them ^[5]. In recent years, infections caused by MDR have become endemic in many hospitals ^[6]. Nosocomial infections caused by MDR microorganisms not only lead to increased mortality and complications and treatment costs, but also pose a great threat to patients' lives ^[7]. These bacteria can cause a wide range of diseases, including bacteremia, pneumonia, and urinary tract infection, which can lead to significant mortality and complications, especially in ICU patients ^[8].

Considering that the rate of multi-drug resistance patterns among gram-negative pathogens in ICU is several times higher than in other parts, this study was designed to examine the pattern of sensitivity in gram-negative MDR bacteria among patients admitted to the ICU of Shahid Sadoughi Hospital in Yazd, Iran.

MATERIALS AND METHODS

This cross-sectional study was conducted in the ICU of Shahid Sadoughi Hospital in Yazd, Iran during 2020. It was performed after receiving the code of ethics from the ethics committee of Shahid Sadoughi University of Medical Sciences of Yazd, Iran. In this research, all samples related to patients admitted to the ICU including blood, cerebrospinal fluid, urine, lung secretions, feces, pleural fluid, pus, peritoneal fluid, and bronchoalveolar lavage fluid were sent to the microbiology laboratory for microbial culture. The sampling method was census. Sampling was done under sterile conditions and according to the standard method from the main place of infection and with the appropriate method (using swab, aspiration with a syringe, sampling, etc.). The samples were cultured on Blood Agar and EMB. After culturing, the samples

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were kept at a temperature of 37°C for 24 h. After this time, if the microorganism had grown in both environments, it was considered as gram-negative. To determine the species of bacteria, these bacteria were cultured in differential media and based on the results of these media and according to the existing differential tables, the name and species of bacteria were found. Disc diffusion method was used to determine antibiotic sensitivity on Mueller Hinton Agar medium. Data analysis was done by SPSS software (Version 26).

RESULTS

A total of 310 cultures related to MDR gram-negative bacteria were investigated from patients admitted to the ICU during the study. 171 patients (55.2%) were men and 139 patients (44.8%) were women. Among the samples, the most samples were related to bronchoalveolar

lavage with 144 samples (46.5%), followed by blood (58 samples or 18.7%) and urine (54 samples or 17.4%).

The most common gram-negative bacteria in cultured samples were *Acinetobacter* (105 cases or 33.9%), *E. coli* (74 cases or 23.9%) and *Klebsiella pneumoniae* (64 cases or 20.6%) respectively. In the investigation of the antibiotic prescription status, 298 patients (96.1%) had received antibiotics before sending the culture and only 12 patients (3.9%) had not received any antibiotics.

The most common antibiotics prescribed in these patients were meropenem (49.6%), vancomycin (33.5%) and clindamycin (18.1%), respectively. The highest sensitivity was to meropenem and vancomycin. Only meropenem was significantly more match in women than in men (p value=0.014) (Table 1).

Table 1: The compatibility of prescribed antibiotics with antibiotic sensitivity results in Gram-negative bacteria according to gender

Gender Antibiotic	Men Number (%)	Women Number (%)	Total Number (%)	P value
Ceftriaxone	12 (57.1)	13 (61.9)	25 (59.5)	0.753
Total	21 (100)	21 (100)	42 (100)	
Vancomycin	36 (61)	26 (63.4)	62 (62)	0.808
Total	59 (100)	41 (100)	100 (100)	
Clindamycin	23 (69.7)	12 (57.1)	35 (64.8)	0.346
Total	33 (100)	21 (100)	54 (100)	
Meropenem	50 (62.5)	55 (80.9)	105 (70.9)	0.014
Total	80 (100)	68 (100)	148 (100)	
Linezolid	11 (47.8)	8 (72.7)	19 (79)	0.171
Total	23 (100)	11 (100)	24 (100)	
Levofloxacin	17 (77.3)	4 (57.1)	21 (72.4)	0.299
Total	22 (100)	7 (100)	29 (100)	
Ceftazidime	6 (85.7)	5 (100)	11 (91.6)	0.377
Total	7 (100)	5 (100)	12 (100)	
Piperacillin/tazobactam	16 (80)	2 (50)	18 (75)	0.206
Total	20 (100)	4 (100)	24 (100)	
Colchicine	2 (40)	4 (80)	6 (60)	0.197
Total	5 (100)	5 (100)	10 (100)	
Colomycin	11 (91.7)	9 (90.9)	20 (90.9)	0.892
Total	12 (100)	10 (100)	22 (100)	
Cotrimoxazole	5 (83.3)	6 (86.5)	11 (84.6)	0.906
Total	6 (100)	7 (100)	13 (100)	
Cefepime	5 (83.3)	2 (5.4)	7 (16.2)	0.571
Total	6 (100)	37 (100)	43 (100)	
Targocid	10 (76.9)	2 (40)	12 (66.6)	0.137
Total	13 (100)	5 (100)	18 (100)	
Ciprofloxacin	2 (66.7)	3 (75)	5 (71.4)	0.809
Total	3 (100)	4 (100)	7 (100)	
Ampicillin/Sulbactam	0 (0)	1 (33.3)	1 (25)	0.505
Total	1 (100)	3 (100)	4 (100)	
Amikacin	6 (75)	1 (20)	7 (53.8)	0.053
Total	8 (100)	5 (100)	13 (100)	
Imipenem	9 (75)	8 (66.7)	17 (70.8)	0.635
Total	12 (100)	12 (100)	24 (100)	
Tobramycin	1 (100)	1 (50)	2 (66.6)	0.053
Total	1 (100)	2 (100)	3 (100)	
Metronidazole	6 (46.3)	13 (76.5)	19 (63)	0.088
Total	13 (100)	17 (100)	30 (100)	

Among antibiotics only clindamycin significantly had the most compatibility in blood and urine and the least its compatibility was observed in wound (p value=0.037).

DISCUSSION

In the current study, more samples were related to bronchoalveolar lavage and blood. The most common gram-negative microorganism was *Acinetobacter*. The most common antibiotic prescribed was meropenem. The most sensitivity was also related to meropenem.

A study was done to distinguish the bacteria and recognize the antibiotics susceptibility outline of the lower respiratory tract strains related to the ICU patients. 69.5% of the cultures were positive. The

most frequent gram negative was *Pseudomonas aeruginosa*. The rate of resistance was very high among gram negatives especially to ciprofloxacin and ceftazidime. Lowest amount of the resistance was associated with meropenem [9].

Another study investigated the prevalence of gram negative microorganisms in clinical samples and their antibiotic sensitivity. *E. coli* was the most common organism. This bacterium was very sensitive to cephalosporins and the highest resistance was to quinolones [10].

A study in Isfahan was conducted to assay the resistance pattern of Gram negatives in the patients with Urinary infections. The most

common organism was *E. coli*. *E. coli* was more sensitive to Nitrofurantoin and the highest resistance rate was to Nalidixic acid [11].

Another study was performed in one of the main hospitals of Egypt. The pathogens were more related to blood and urine cultures. *Klebsiella* was the most common organism. The lowest rate of resistance was to nitrofurantoin. Also, *Pseudomonas* and *Acinetobacter* exhibited very high susceptibility (100%) to colistin [12].

CONCLUSION

The pattern of antibiotic sensitivity of gram-negative bacteria and its compatibility with the treatment showed a relatively favorable situation in the present study. However, it is still necessary to identify the most common organisms and patterns of antibiotic sensitivity in the ICU patients for preventing the resistance.

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Conflicts of interest

Authors declare that have no conflict of interest.

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