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Antibacterial Activities of Various Antibiotics Against Clinical Isolates of *Escherichia coli*

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ABSTRACT

Antibiotics are a vital tool in the treatment of a wide range of bacterial diseases, but their overuse and abuse are leading to bacterial resistance. Objectives: To check the antibacterial activities of various antibiotics against *E. coli*. **Methods:** Collection of samples was done from patients at the Fatima Memorial Hospital's pathology department in Lahore, Pakistan, for this investigation. Total of 170 clinical isolates of *E. coli* were isolated from all samples collected. Conventional culture and biochemical tests were used for the identification of bacteria. Antibacterial activity were assessed by comparing antibiotic susceptibility patterns of all clinical isolates to commercial antibiotic discs (cefazolin, cefepime, cefixime, cefotaxime, cefoxitin, ceftriaxone, ceftazidime, cefuroxime, cephalothin, amikacin, amoxycillin, ampicillin, Augmentin, ciprofloxacin, clindamycin, gentamycin, imipenem, levofloxacin, linezolid, meropenem, nalidixic acid, nitrofurantoin, norfloxacin, ofloxacin, rifampicin, and vancomycin) by using Kirby-Bauer disc diffusion method. **Results:** Antibiotics which showed high sensitivity against *Escherichia coli* were imipenem (100%), nitrofurantoin (100%), gentamycin (99%) and amikacin (92%). *Escherichia coli* were showing high resistance to meropenem (100%), ceftazidime (98%), cefepime (78%), ofloxacin (78%), cefuroxime (78%), cefazolin (74%) and ciprofloxacin (65%). **Conclusions:** We concluded that meropenem, ampicillin, cefuroxime and cefepime showed widespread resistance against all *E. coli* clinical isolates. There is need to improve the technical facilities to minimize the antibiotic resistance by selecting appropriate antibiotics and proper hand washing recommended.

INTRODUCTION

Antibiotics are powerful tools that are when used properly in certain infections can save life. They also kill germs by preventing them from replicating. Penicillin was the very first antibiotic to be discovered [1]. Antibiotic resistance is not a latest phenomenon, since the introduction of antibiotic (penicillin), bacteria are noted to posses some resistance. Antibiotic resistance refers to bacteria's capacity to withstand the effects of antibiotics [2]. Most bacterial illnesses can now be treated simply with medicines; but, as bacteria become more resistant to these medications, treatment becomes more complicated. In the late 1920s, Alexander Fleming developed penicillin. The availability of new medicines has greatly improved our capacity to treat illnesses that are difficult to treat [3]. One of the primary causes of illness and death worldwide is infection brought on by bacteria. The spread of resistant microorganisms is crucial in this situation. The rapid emergence of multidrug resistance in bacteria poses a severe threat to global public health due to the lack of treatment options and the slow development of new antibiotics [4-6]. Antibacterial resistance has been steadily increasing in Pakistan. The majority of bacteria obtained from various diseases were increasingly becoming resistant to conventional antibiotics, according to these data [7]. In Pakistan, medications are abused for no obvious cause, and as a result, microbes are becoming resistant to these medicines. In Pakistan, just a few studies on the prevalence of antibiotic resistant bacteria connected to various illnesses have surfaced. There have been a few recorded cases of antibiotic resistance in

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Pakistan. Acinetobacter species have demonstrated significant levels of resistance to a variety of antibiotics, including Carbapenem. Salmonella species in Pakistan were also becoming more resistant to Ceftriaxone and Quinolone [8-10]. The majority of bacterial isolates have developed antibiotic resistance, according to a study on the frequency and identification of bacteria such as Klebsiella species, Enterobacter species, and Enterobacteria. Bacteria was commonly resistant to Erythromycin about 39.9%,after that Ampicillin 33.8%, followed by Cefoxitin about 12.8%, then Tetracycline of 5%, afterward Streptomycin 4%, Nalidixic acid 2.1%, after that Colistin 1.4% and Kanamycin 1.4%. These findings highlight the need of increasing patient awareness of optimal antibiotic prescription and use [11-13].

METHODS

This was a cross-sectional study. The research was carried out in the Fatima Memorial Hospital's Pathology Department in Lahore, Pakistan. During a period of one year, a total number of 1,400 samples were collected from various wards at Fatima Memorial Hospital, including blood, pus, swabs, sputum, urine, CSF, and semen. A sterile container was used to collect each sample. The container of sample was labelled with the collection time, source, and date and taken to the lab for analysis within an hour of being collected. Samples from the sample container were grown on specific medium plates (Eosin thiazine Agar, Mannitol Salt agar, TCBS Agar, MSA agar, MacConkey Agar, enteric bacteria enteric bacteria Agar). The plates were then kept in an incubator for 24 hours at 37 °C. To establish pure cultures that could be preserved, the colonies were then inoculated over agar plates. Clinical isolates were identified by their colonial morphology on Mac-Conkey agar, Cystine-Lactose-Electrolyte-Deficient (CLED) agar and Blood agar. Colony features had been studied using isolated colonies. For the identification of these species, standard identification and susceptibility procedures were used. Gram negative bacteria appeared as pink color organisms in gram stained smears. The sensitivity or susceptibility of microorganisms to different antibiotics, as well as their patterns of resistance, were studied using antibiotic susceptibility testing. The Kirby-Bauer disc diffusion technique was used in this study to assess the bacteria's susceptibility to antibiotics. A colony from the plate was entirely mixed and aseptically emulsified in a tube containing sterile saline solution. Muller Hinton produced the agar plates. A sterile cotton swab was dipped into the broth culture of the organism before being streaked at least four to six times across the dry MHA plate surface. The antibiotic discs were placed using sterile forceps. The MHA plates were inverted and incubated at 37 ^{0}C for 24 hours after all of the discs were appropriately positioned. After incubation, Bacterial growth was seen surrounding each disc. If the clinical isolate was responsive to an antibiotic, a definite area of "no growth" was seen around that specific disk. The size of zone of inhibition for each antibiotic is measured in millimeters with a metric ruler and compared to a standard interpretation chart to determine if the isolate is susceptible, intermediately susceptible, or resistant to antibiotic. SPSS (Statistical Package for Social Sciences) version 22.0 was used to tabulate and analyze the data. Antibiotic sensitivity, and resistance were all assessed quantitatively. The sensitivity and resistance was measured in percentage to indicate the antibacterial activity of an antibiotic.

RESULTS

A total 1400 biological samples were evaluated for culture and antibiotic sensitivity test in the department of microbiology, Fatima memorial hospital, Lahore. Out of 1400 clinical isolates, 170 (12.14%) clinical isolates were *E. coli*. Sensitivity pattern of *Escherichia coli* had been shown in table 1**.** Antibiotics which showed high sensitivity against *Escherichia coli* were imipenem (100%), nitrofurantoin (100%), gentamycin (99%) and amikacin (92%). The cefazolin show sensitivity of 26%, ciprofloxacin (35%), cefotaxime (41%). *Escherichia coli* were showing high resistance to meropenem (100%), ceftazidime (98%), cefepime (78%), ofloxacin (78%), cefuroxime (78%), cefazolin(74%)and ciprofloxacin(65%).

Antibacterial Agent	Escherichia coli (170)	
	Sensitive n(%)	Resistance n(%)
Amikacin	156 (92.0%)	14 (8.0%)
Cefazolin	44 (26.0%)	126 (74.0%)
Cefepime	31 (18.0%)	133 (78.0%)
Cefotaxime	70 (41.0%)	100 (59.0%)
Ceftazidime	2 (1.0%)	167 (98.0%)
Cefuroxime	37 (22.0%)	133 (78.0%)
Ciprofloxacin	60 (35.0%)	111 (65.0%)
Gentamycin	168 (99.0%)	2 (1.0%)
Imipenem	170 (100.0%)	0 (0.0%)
Linezolid	168 (99.0%)	2 (1.0%)
Meropenem	0 (0.0%)	170 (100.0%)
Nitrofurantoin	170 (100.0%)	0 (0.0%)
Ofloxacin	39 (23.0%)	133 (78.0%)

Table 1: Antibacterial activities against *Escherichia coli*

DISCUSSION

All around the world, diseases brought on by multidrug-resistant Gram-negative bacteria have sharply increased in recent years. It discusses the frequency of Gram-negative bacteria in livestock, its epidemiology, its inherent characteristics, the patterns of the emergence of antibiotic resistance, as well as reservoirs, transmission mechanisms, risk factors for infection, mortality, and treatment and preventative strategies [14, 15]. On

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analyzing the sensitivity pattern indicated by Gram negative bacteria, different antibiotics were found to be sensitive with various degrees. Antibiotic which showed high sensitivity i.e. (100%) was Imipenem, (99%) was Gentamycin against *Escherichia coli*. The most effective antibiotic was Imipenem (100%) and Gentamycin (99%) in case of *Escherichia coli*. This is in line with the sensitivity result obtained in a study done in 2011 [16]. According to previous report Cefepime, followed by amikacin (more than 99% of isolates susceptible), was the next most effective treatment against *Escherichia coli* isolates (all entirely susceptible). Aztreonam, aminoglycosides, second- and third-generation cephalosporins, and fluoroquinolones were all effective against more than 90% of all isolates [17]. Antibiotics which showed high sensitivity against *Escherichia coli* were Imipenem (100%), Nitrofurantoin (100%), Gentamycin (99%) and Amikacin (98%). Similar results were also seen by Barakoti, *et al* [18]. According to a study from India, E. coli that produces ESBLs is 100%, 89%, and 86% susceptible to imipenem, nitrofurantoin, and amikacin, respectively. B-lactam and monobactam antibiotics are ineffective for treating patients with these types of infection. Amikacin and nitrofurantoin are discovered to be alternatives for treating such patients at low cost because co-resistance to non-b lactam antibiotics like norfloxacin, co-trimoxazole, and gentamicin was seen [19]. *Escherichia coli* were showing high resistance to meropenem (100%), ceftazidime (98%), cefepime (78%). Meropenem demonstrates resistance to hydrolysis by the majority of -lactamases, including ESBLs and AmpC -lactamases, but may be impacted by carbapenemases such as metallo—lactamases, serine carbapenemases, and oxacil-linases with carbapenemase activity (such as OXA-23, OXA-24 and OXA-58) [20].

CONCLUSIONS

From the results of the present study, it is concluded that antibiotic resistance has become more common in *Escherichia coli*. In this study, Linezolid, Imipenem, Amikacin, and Gentamycin had the best antibacterial action against *Escherichia coli* bacterial infections. Antibiotic resistance should be controlled and prevented by putting in place preventive measures.

Conflicts of Interest

The authors declare no conflict of interest

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