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Original Article

Sensitivity and Resistivity of Various Antibiotics Against of P*seudomonas aeruginosa* in Clinical Isolates

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ABSTRACT

Antibiotics are an essential therapy for a variety of bacterial infections, but misuse and overuse of them is encouraging bacterial resistance. **Objective:** To check different drugs' antibacterial effects on *Pseudomonas aeruginosa* was the goal. **Methods:** For this experiment, samples were taken from patients in the pathology division of the Fatima Memorial Hospital in Lahore, Pakistan. From all of the samples gathered, 170 clinical isolates of *P. aeruginosa* were discovered. To identify bacteria, traditional culture and biochemical techniques were performed. Antibacterial activity was determined by comparing the antibiotic susceptibility patterns of all clinical isolates to commercial antibiotic discs (cefazolin, cefepime, cefixime, cefoxitin, ceftriaxone, ceftazidime, cefuroxime, cephalothin, amikacin, amoxycillin, ampicillin, Augmentin, ciprofloxacin, clindamycin, gentamycin, imipenem. **Results:** Imipenem (100% sensitivity), Ceftazidime (99%), Linezolid (99%), Clindamycin (99%), Gentamycin (92%), Ciprofloxacin (88%), Levofloxacin (78%), and Cefotaxime (71%), among other antibiotics, shown remarkable sensitivity against Pseudomonas aeruginosa. **Conclusions:** We came to the conclusion that all clinical isolates of *P. aeruginosa* exhibited broad resistance to meropenem, ampicillin, cefuroxime, and cefepime. To reduce antibiotic resistance, technical infrastructure must be improved. Appropriate antibiotic selection and advised hand washing are two such measures.

INTRODUCTION

P. aeruginosa is a kind of bacterium that may infect the skin, urinary system, respiratory tract, and bloodstream, among other areas of the body. Because of this bacterium's inherent and acquired resistance to antibiotics, infections caused by it are often difficult to cure. Therefore, finding novel and potent medicines is essential for stopping and containing the spread of *P. aeruginosa* infections. This review discusses the antibacterial effects of several drugs on *P. aeruginosa* clinical isolates. Numerous clinical issues are caused globally by multi-drug resistant microorganisms. It is recognized that the extensive use of antibiotics contributes to bacteria that cause nosocomial and community-acquired illnesses developing increased resistance [1]. Particularly in developing nations, infectious illnesses brought on by resistant bacteria are to blame for increasing morbidity and death rates as well as rising healthcare expenses. Nearly 10% of all surgical site, respiratory tract, and urinary tract infections acquired in hospitals are caused by the opportunistic gramme negative bacteria *Pseudomonas aeruginosa,* which often develops in conjunction with significant underlying illnesses [2, 3]. It is a primary source of morbidity owing to burn wound infection and is often linked to otitis media, nasal infections, and other conditions [4, 5]. To treat systemic infections, *P. aeruginosa* is naturally resistant to the majority of antibiotics now on the market, including

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aminoglycosides, anti-pseudomonal penicillin's, newer cephalosporins, imipenem, and fluoroquinolones [6-8]. Antibiotic resistance has now become a health problem worldwide. Every year, approximately 7 billion causalities throughout the world are as a result of infections that have developed resistance to the antibiotics used to treat them. Resistance is a common occurrence in nature. Only a few germs survive being exposed to pharmaceuticals that are supposed to kill them, and these microbes pass on their drug resistance to others. In view of the findings that overuse and abuse of antibiotics, as well as inadequate disease control, is hastening antibiotic resistance, this issue has gained prominence [9, 10]. Studies have been done to determine how well different antibiotics work against *P. aeruginosa*. According to research by Gill, carbapenems like imipenem and meropenem were very efficient against clinical isolates of *P. aeruginosa* [11, 12]. The fluoroquinolones ciprofloxacin and levofloxacin were similarly effective against *P. aeruginosa*, according to different research in North America.

METHODS

A cross-sectional investigation was conducted. The study was conducted in Lahore, Pakistan, in the pathology division of the Fatima Memorial Hospital. A total of 1,400 samples, including blood, pus, swabs, sputum, urine, CSF, and semen, were gathered from different wards at Fatima Memorial Hospital over the course of a year. Each sample was taken in a sterile container. Within an hour after being collected, the sample container was labelled with the collection time, source, and date and transported to the lab for analysis. On certain medium plates, samples from the sample container were grown (Eosin thiazine Agar, Mannitol Salt agar, TCBS Agar, MSA agar, MacConkey Agar, enteric bacteria enteric bacteria Agar). After that, the plates were stored for 24 hours at 37 °C in an incubator. The colonies were then injected onto agar plates to create pure cultures that could be stored. The colony morphology of clinical isolates on Mac-Conkey agar was used to identify them. Isolated colonies were used to study the characteristics of colonies. Standard identification and susceptibility techniques were used to the identification of these species. In gramme stained smears, gramme negative bacteria were seen as pink-colored organisms. Antibiotic susceptibility testing was used to examine the sensitivity or susceptibility of bacteria to various antibiotics as well as their patterns of resistance. The susceptibility of the bacteria to antibiotics was evaluated in this research using the Kirby-Bauer disc diffusion method. In a tube containing sterile saline solution, a colony from the plate was thoroughly mixed and aseptically emulsified. The agar plates were created by Muller Hinton. A sterile cotton swab was used to streak the dried MHA plate surface at least four to six times after being dipped into the organism's broth culture. Using sterile forceps, the antibiotic discs were positioned. After all of the discs were positioned correctly, the MHA plates were inverted and incubated at 37 0C for 24 hours. Bacterial growth was seen around each disc after incubation. A distinct region of "no growth" was seen around that particular disc if the clinical isolate was susceptible to an antibiotic. To establish whether an isolate is susceptible, intermediately susceptible, or resistant to an antibiotic, the size of the zone of inhibition for each drug is measured in millimeters using a metric ruler and compared to a standard interpretation chart. To tabulate and analyze the data, SPSS version 22.0 was utilized. Both antibiotic sensitivity and resistance were statistically evaluated. The proportion of sensitivity and resistance was used to calculate an antibiotic's antibacterial activity.

RESULTS

Antibiotics which showed high sensitivity against *Pseudomonas* species were Imipenem (100%), Ceftazidime (99%), Linezolid (99%), Clindamycin (99%), Gentamycin (92%), Ciprofloxacin (88%), Levofloxacin (78%), and Cefotaxime (71%). *Pseudomonas* species had shown high resistance to Meropenem (100%), Cefoxitin (99%), Ampicillin (99%) and Nalidixic acid (99%). Other antibiotics showing high resistance were Augmentin (99%), Cefazolin (97%). Cefepime (94%), Cefuroxime (93%), Cephalothin (92%), Cefixime (87%), Norfloxacin (70%) (table 1).

Antibacterial agent	*Pseudomonas aeruginosa* (144)	
	Sensitive n (%)	Resistance n (%)
Amikacin	141 (98.0%)	3 (2.0%)
Ampicillin	1 (1.0%)	143 (99.0%)
Augmentin	1 (1.0%)	143 (99.0%)
Cefazolin	4 (3.0%)	140 (97.0%)
Cefepime	6 (4.0%)	135 (94.0%)
Cefixime	19 (13.0%)	125 (87.0%)
Cefotaxime	101 (70.0%)	43 (30.0%)
Cefoxitin	1 (1.0%)	143 (99.0%)
Ceftazidime	143 (99.0%)	1 (1.0%)
Cefuroxime	10 (7.0%)	134 (93.0%)
Cephalothin	12 (8.0%)	132 (92.0%)
Ciprofloxacin	127 (88.0%)	17 (12.0%)
Clindamycin	143 (99.0%)	1 (1.0%)
Gentamycin	143 (99.0%)	1 (1.0%)
Imipenem	144 (100.0%)	1 (1.0%)
Levofloxacin	112 (78.0%)	32 (22.0%)
Linezolid	143 (99.0%)	1 (1.0%)
Meropenem	0 (0.0%)	144 (100.0%)
Nalidixic Acid	1 (1.0%)	143 (99.0%)
Nitrofurantoin	65 (45.0%)	79 (55.0%)
Norfloxacin	43.2 (30.0%)	100.8 (70.0%)
Ofloxacin	94 (65.0%)	50 (35.0%)

Table 1: Antibacterial activities against *Pseudomonas aeruginosa*

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DISCUSSION

It has been shown that certain resistant clinical isolates of *P. aeruginosa* are susceptible to the inhibitory effects against Imipenem, Ceftazidime, Linezolid, Clindamycin, Gentamycin (92%), Ciprofloxacin, Levofloxacin, and Cefotaxime. The fact that none of the antimicrobial drugs were successful in treating all of the multi-drug tested strains showed the present difficulty in treating nosocomial infections that are multi-drug resistant [14, 15]. *P. aeruginosa* isolates from earlier research by Servin shown partial or total resistance to antibiotics [16]. Unluckily, *P. aeruginosa* strains completely resisted ampicillin and cephalexin. Its sensitivity to other strong antibiotic substances, such as those more often used to treat hospital infections, such as ceftriaxon, chloramphenicol, cefotaxime, ceftazidime, tobramycin, piperacilin, imipenem, gentamicin, and amikacin, was also examined by Fluit *et al.*, [17-19]. Natural sources of lactic acid bacteria include dairy products, seafood, vegetables, and cereals. They guard against urinary tract infections and are a part of healthy vaginal flora. In actuality, several strains of the genus Lactobacillus are capable of colonizing certain areas of the body, such as the gastrointestinal tract, uro-genital tract, and oral cavity, where they are crucial to the competitive exclusion of pathogens. It turns out that the antimicrobial action of Lactobacillus strains against bacterial pathogens is multifaceted and involves the generation of compounds including bacteriocin-like molecules, hydrogen peroxide, lactic acid, and unknown heat-stable, non-lactic acid chemicals. Competition for nutrients, adhesion inhibition of infections to surfaces, and immune system modelling have all been postulated as additional pathways for their function. Imipenem (100% sensitivity), Gentamycin (99%), Ceftazidime (99%), Linezolid (99%), and Clindamycin (99%) were among the antibiotics that shown great sensitivity against Pseudomonas aeruginosa. Barakoti *et al.*, saw comparable outcomes [20].

CONCLUSIONS

The findings of the current investigation of *P. aeruginosa* had a higher prevalence of antibiotic resistance. In this investigation, the most effective antibacterial agents against *P. aeruginosa* bacterial infections were Linezolid, Imipenem, Amikacin, and Gentamycin. By using preventative measures, antibiotic resistance should be managed and avoided.

Conflicts of Interest

The author declares no conflict of interest.

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