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Sensitivity and Resistance Pattern of 18 Commercially Available Antibiotics against *Pseudomonas* Species Isolated from Cloacal Swab of Domestic Pigeons

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ABSTRACT

Antibiotic resistance is a growing concern globally, leading to increased morbidity and mortality due to bacterial infections. **Objective:** To determine the sensitivity of *pseudomonas* species against various antibiotics. **Methods:** A total of 120 cloacal swab samples were collected from domesticated pigeons in the Narowal district of Pakistan and examined in a laboratory. After that gram staining was performed. Motility test, oxidase, Indole, catalase, coagulation and antibiotic susceptibility test was performed. **Results:** The results showed that Amikacin, Trimethoprim, and Clarithromycin were the most effective antibiotics against *pseudomonas* species, with 93.94% sensitivity to each. On the other hand, 54.55% of the *pseudomonas* strains showed sensitivity to Gentamicin, while 18.18% showed resistance. **Conclusion:** The domestic pigeons are *pseudomonas* species carriers and spread the disease to people and other animals via their faeces. The findings highlight the need for ongoing monitoring and research to understand the development and spread of antibiotic resistance and to ensure the effective treatment of bacterial infections.

INTRODUCTION

Antibiotics are an essential group of therapeutic drugs used to kill bacteria on various levels (tissues, organs, organ systems) in the human body against different bacterial infections. These antibiotics had played a significant role for the treatment as well as the prevention of bacterial diseases. The effectiveness of antibiotics against bacterial infections cannot be denied [1]. Karimzadeh et al., finds that overall 50 to 60 percent of all nosocomial infections in the United States were caused by antibiotic-resistant bacteria [2]. Antibacterial resistance in the United States had resulted in approximately 23,000 deaths per year. The direct and indirect overall public costs of antibacterial resistance in the US had been estimated to

be 20 million dollar and 35 billion dollar, respectively. In the countries of European Union, likely 25,000 deaths were expected due to antibiotic resistant bacteria, costing 1.5 billion dollar annually in both direct and indirect costs. The availability of new antibiotics had significantly increased our ability to treat complex infections. Bacterial infections are among the most important causes of morbidity and mortality worldwide [3, 4]. Spread of resistant microorganisms is playing a significant role in this regard. Previous studies showed that Pakistan is a developing country with poor healthcare facilities and economic resources [5, 6]. Lack of access to basic healthcare facilities, unhygienic lifestyle and misuse of substandard

antibiotics by the patients added up to deteriorate the antibiotic resistance situation. Misuse of antibiotics are directly linked to the resistance in bacteria and multi drug resistant (MDR) bacteria are becoming more significant. Scientists refer that antibacterial resistance or antibiotic resistance is a very serious issue for the health of both humans and animals [7, 8]. The cost of United States human health care system was estimated to be 100 million dollars to 30 billion dollars annually due to antibacterial resistance. The Study conducted in Germany to prevail the antibiotic resistance had shown that there was a 75% increase in resistance of *E. coli* to tetracycline, 80% increase to Ampicillin and 90% increase to sulfonamides [9-11]. Furthermore, for *S. Aureus*, resistance increased by 50% to 60% to penicillin and by 400% to Gentamicin. Hsueh et al., showed that the antibiotic resistance results in bacteria due to change by some approach that eliminates or reduces the effectiveness of antibacterial agents apply for treatment of infections [12, 13]. The bacteria cause more damage to human body by survival and continuous multiplication. In this analytical experimental study, a total of 120 Cloacal swab samples of domesticated Pigeons were collected from different areas of District Narowal. The experimental work was carried out at the Department of Microbiology, Sughra Shafi Medical Complex Narowal, Pakistan over a period of one year.

METHODS

Within an hour of collection, cloacal swab samples were sent to a lab for examination in a sterile container labelled with the source, date, and time of collection. Samples were grown on specific medium such as Blood Agar, MacConkey Agar, and Chocolate Agar after sample collection. The agar plates were then incubated at 37°C for 24 hours. Following incubation, isolated colonies were seen, and the cfu/ml value was determined. To obtain a pure culture for storage, the colonies were then streaked on agar plates. Colonial morphology of the isolates was identified by their growth on MacConkey agar and Blood agar base. On MacConkey agar, *Pseudomonas* species form flat and smooth colonies while on Blood agar they produce smooth and mucoid colonies. After that gram staining was performed. Motility test, oxidase, Indole, catalase, coagulation and antibiotic susceptibility test was performed. Data were analyzed using SPSS.

RESULTS

Figure 1 is showing the sensitivity of *pseudomonas* species against different tested antibiotics. Amikacin (AK), Trimethoprim (TMP) and Clarithromycin (CLR) are most effective against concerned bacteria. *Pseudomonas* showed 6.06% resistance and 93.94% were showing sensitivity against TMP antibiotic. Clarithromycin (CLR)

showed 93.94% sensitivity against *Pseudomonas*. 18.18% *Pseudomonas* were showing resistance and 54.55% were showing sensitivity against Gentamicin (CN).

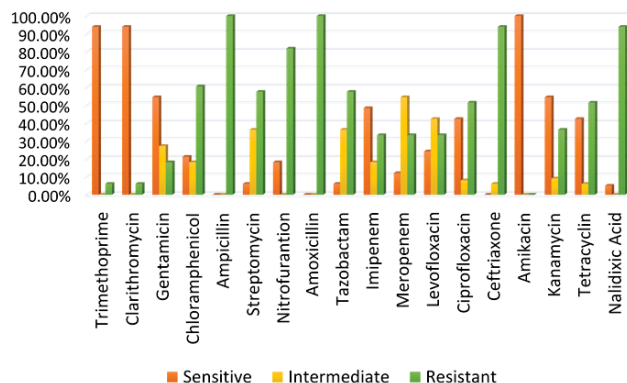


Figure 1: Antibiotic resistance and sensitivity of *P. aeruginosa*

DISCUSSION

In a related study using domestic bird samples, Varriale et al., found that *P. aeruginosa* was present in 59/75 samples, whereas *E. coli* was present in 231/755 samples [14]. A few species of Gram-negative bacteria, including *Citrobacter* spp., *Pantoea* spp., *Serratia* spp., and *Morganella* spp., were furthermore sometimes identified. *P. aeruginosa* bacteria were resistant to sulfamethoxazole-trimethoprim and amoxicillin/clavulanic acid in 45/59 (76.3%) cases. Doxycycline resistance was seen in 42/59 (71.2%) cases, enrofloxacin resistance in 46/59 (78%) cases, gentamicin resistance in 17/59 (28.9%) cases, and oxytetracycline resistance in 48/59 (81.3%) cases. Many of the strains exhibited multidrug resistance. A total of 118/231 (51.1% of the *E. coli* isolates) were resistant to amoxicillin/clavulanic acid, 127/231 (55%) were resistant to sulfamethoxazole-trimethoprim, 132/231 (57.1%) were resistant to doxycycline, 92/231 (40%) were resistant to enrofloxacin, 61/231 (26.4%) were resistant to gentamicin. The majority of strains *P. aeruginosa* also exhibited multidrug resistance [15, 16]. Perwaiz et al., elaborate in their study that all clinical isolates (Gram positive) showed complete sensitivity to Vancomycin (VA), Klaricid (KL), Fusidic acid (FU), Vibramycin (VI), Erythromycin (ER), Linezolid (LI), Oxiccillin (OX) and Nalidixic Acid (NA) while Amoxicillin (AM), Cefotaxime (CE), Ciprofloxacin (CI), Ampicillin (AMP). All clinical isolates (Gram negative) showed complete sensitivity to Tazocin (TA), Meteronidazole (ME), Ciprofloxacin (CI), Ofloxacin (OF), Gentamycin (GA), Levofloxacin (LE), Gatifloxacin (GA) while complete resistance to Cefotaxime (CE), Nalidixic Acid (NA), Oxiccillin (OX), Norfloxacin (NO) [17]. Vancomycin, Klaricid and Fusidic acid showed excellent antibacterial activity against gram positive bacteria and no resistant isolate was detected against these antibiotics in this study.

Taj *et al.*, also had been reported resistance in other areas of Pakistan for Vancomycin, Klaricid and for Linezolid [18, 19]. They also showed in their study that Gram negative bacteria had also been found sensitive to Fusidic acid, Vibramycin and erythromycin. Long and Hammer showed in their research that all gram-negative isolates was resistant to Amoxicillin, Cefotaxime, Ciprofloxacin and Ampicillin and showed no therapeutic activity against bacterial infections [19]. Similar results had been obtained in other areas of Pakistan. Bhatiani and Chandna showed in their study that gram positive isolates (MRSA) were totally resistant to Amoxicillin and Cefotaxime in this study [20]. MRSA had showed complete resistance to Oxacillin and Penicillin. Similar reports had also obtained for the antibacterial activity of Cefotaxime.

CONCLUSIONS

The domestic pigeons are pseudomonas species carriers and spread the disease to people and other animals via their faeces. Transmission must be prevented using preventative measures. Before recommending antibiotics to patients, an antibiotic susceptibility test (AST) should be conducted.

Conflicts of Interest

The authors declare no conflict of interest.

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