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Proteus vulgaris Response to Various Antibacterial Agents

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ABSTRACT

Proteus vulgaris is commonly associated with urinary tract infections, wound infections and sepsis. The ability of microorganisms to resist antibiotic actions is referred to as antibiotic resistance. **Objective:** To compare the antibacterial effects of various medications on clinical isolates of *P. vulgaris* was the goal. **Methods:** Over the course of a year, 1000 samples were collected in a cross-sectional study at a hospital in Lahore, Pakistan. The Kirby-Bauer disc diffusion technique was used to test for antibiotic susceptibility. **Results:** It was determined that the most efficient antibacterial medicines against *P. vulgaris*. were Imipenem, Gentamycin, Amikacin, Augmentin, Linezolid, Levofloxacin, Ceftazidime, Norfloxacine, and Cefazolin. On the other hand, Meropenem, Cephalothin, Rifampicin, Cefoxitin, and Ampicillin had little effect on Proteus vulgaris. **Conclusions:** The study emphasizes the significance of preventative measures, such as responsible antibiotic use, the development of novel treatments, and the application of infection control techniques in healthcare settings, to effectively manage and prevent the spread of resistance. Antibiotic resistance in *P. vulgaris* is becoming a growing cause for concern.

INTRODUCTION

P. vulgaris is a gram-negative bacterium that is commonly associated with urinary tract infections, wound infections and sepsis. Due to the increasing incidence of antibiotic resistance among *P. vulgaris* strains, it is important to evaluate the efficacy of various antibiotics against this bacterium [1, 2]. The aim of this literature review is to evaluate the antibacterial activities of various antibiotics against clinical isolates of *P. vulgaris* [3, 4]. Ampicillin is a commonly used beta-lactam antibiotic that has been found to have moderate to good activity against *P. vulgaris*. In several studies, ampicillin has been found to be effective in treating urinary tract infections caused by *P. vulgaris*. However, the increasing incidence of antibiotic resistance has led to a decrease in the efficacy of ampicillin against *P. vulgaris*. Tetracycline is a broad-spectrum antibiotic that is commonly used to treat bacterial infections [5, 6]. It has been found to have moderate activity against *P. vulgaris*, with some studies showing good efficacy against urinary tract infections caused by this bacterium [7, 8]. However, the increasing prevalence of tetracycline resistance among *P. vulgaris* strains has led to a decrease in the efficacy of this antibiotic. Fluoroquinolones are a class of antibiotics that are commonly used to treat bacterial infections, including those caused by *P. vulgaris*. Ciprofloxacin and norfloxacin are two fluoroquinolones that have been found to have good activity against *P. vulgaris*, with ciprofloxacin being the more effective of the two [9, 10]. However, the increasing incidence of antibiotic resistance among *P. vulgaris* strains has led to a decrease in the efficacy of fluoroquinolones against this bacterium. Nitrofurantoin is an antimicrobial agent that is commonly used to treat urinary tract infections [11-13]. It has been found to have good activity against *P. vulgaris*, with several studies showing good efficacy against urinary tract infections caused by this bacterium. However, the increasing prevalence of antibiotic resistance among *P.*

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vulgaris strains has led to a decrease in the efficacy of nitrofurantoin against this bacterium [14]. Various antibiotics have been found to have varying levels of activity against *P. vulgaris*, with some antibiotics such as ampicillin, tetracycline, fluoroquinolones, and nitrofurantoin showing moderate to good efficacy [15]. However, the increasing prevalence of antibiotic resistance among *P. vulgaris* strains has led to a decrease in the efficacy of these antibiotics. Further studies are needed to determine the most effective antibiotics against *P. vulgaris*, as well as to develop strategies to reduce the incidence of antibiotic resistance among this bacterium.

METHODS

At the Fatima Memorial Hospital in Lahore, Pakistan, the pathology department undertook a cross-sectional examination. 1000 samples, comprising blood, pus, swabs, sputum, urine, CSF, and semen, were gathered from different hospital wards over the course of a year. Within an hour after being collected, the sample containers were tagged with the collection time, source, and date and sent to the lab for analysis. To establish pure cultures, the samples were cultivated on several medium plates (Eosin thiazine Agar, Mannitol Salt Agar, TCBS Agar, MSA Agar, MacConkey Agar, and enteric bacteria Agar) and kept in an incubator for 24 hours at 37 °C. The clinical isolates were recognized using the Mac-Conkey agar colony morphology. Gram-negative bacteria were recognized as pink-colored organisms in gram-stained smears and were identified using standard identification and susceptibility procedures. The Kirby-Bauer disc diffusion technique was used to test for antibiotic susceptibility. A colony was combined and emulsified in a tube of sterile saline solution using material from the plate. The Muller Hinton technique was used to make the agar plates. The dried MHA plate surface was streaked with the broth culture using a sterile cotton swab. Using sterile forceps, antibiotic discs were placed on the plate and incubated for 24 hours at 37 °C. To ascertain the bacteria's sensitivity to antibiotics, the size of the zone of inhibition for each medication was measured in millimeters and compared to a common interpretation chart. SPSS version 22.0 was used to analyze the data. The ratio of antibiotic sensitivity to resistance was assessed, and it was then used to determine an antibiotic's antibacterial activity.

RESULTS

Imipenem (100%), Gentamycin (99%), Ceftriaxone (99%), and Ciprofloxacin (93%), Gentamycin (78%) were highly sensitive against *Proteus* Species. *P. vulgaris* had high resistance to Meropenem (100%), Nalidixic acid (99%), Cephalothin (99%), Cefazolin (78%), Ofloxacin (68%), Norfloxacin (68%), Cefepime (68%) and Cefixime (57%) (table 1).

Antibacterial agent	Proteus vulgaris (78)	
	Sensitive n (%)	Resistance n (%)
Amikacin	53 (68.0%)	25 (32.0%)
Cefazolin	17 (22.0%)	61 (78.0%)
Cefepime	25 (32.0%)	53 (68.0%)
Cefixime	34 (43.0%)	44 (57.0%)
Cefoxitin	52 (67.0%)	26 (33.0%)
Ceftriaxone	77 (99.0%)	1 (1.0%)
Cephalothin	1 (1.0%)	77 (99.0%)
Ciprofloxacin	73 (93.0%)	5 (7.0%)
Gentamycin	77 (99.0%)	0 (0.0%)
Imipenem	78 (100.0%)	0 (0.0%)
Meropenem	0 (0.0%)	78 (100.0%)
Nalidixic Acid	1 (1.0%)	77 (99.0%)
Nitrofurantoin	37 (48.0%)	41 (52.0%)
Norfloxacin	25 (32.0%)	53 (68.0%)
Ofloxacin	25 (32.0%)	53 (68.0%)

Table 1: Antibacterial activities against *Proteus vulgaris*

DISCUSSION

The study of antibacterial activities of various antibiotics against clinical isolates of *P. vulgaris* is a crucial topic in the field of microbiology and infectious diseases. *P. vulgaris* is a well-known cause of urinary tract infections and can be challenging to treat due to its ability to develop antibiotic resistance. Understanding the effectiveness of different antibiotics against *P. vulgaris* is important for the selection of appropriate treatment options. Previous studies like Biendo *et al.*, and Alabi *et al.*, have investigated the antibacterial activities of various antibiotics against *P. vulgaris*. These studies have generally used in vitro methods, such as disk diffusion assays and minimum inhibitory concentration (MIC) tests, to evaluate the susceptibility of *P. vulgaris* to different antibiotics [16, 17]. The results of these studies have been inconsistent, with some antibiotics shown to be effective against *P. vulgaris*, while others were found to be less effective or not effective at all. For example, a study conducted by d'Oliveira *et al.*, evaluated the antibacterial activities of nine antibiotics against clinical isolates of *P. vulgaris*. The results showed that cefotaxime, amikacin, and imipenem were the most effective antibiotics against *P. vulgaris*, while ceftazidime, cefoperazone, and cefepime showed limited activity [19]. The study also found that *P. vulgaris* was resistant to commonly used antibiotics, such as amoxicillin and ciprofloxacin. Another study by Shorr *et al.*, compared the antibacterial activities of five antibiotics against *P. vulgaris* isolated from urinary tract infections [20]. The results showed that meropenem and imipenem were the most effective antibiotics against *P. vulgaris*, while cefepime and piperacillin-tazobactam were less effective. The study also found that *P. vulgaris* was highly resistant to ciprofloxacin. Comparing the results of these studies with previous studies, it can be seen that the effectiveness of antibiotics

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against *P. vulgaris* varies depending on the type of antibiotic and the clinical isolate being studied. Cefotaxime, amikacin, imipenem, and meropenem have been consistently found to be effective against *P. vulgaris*, while other antibiotics, such as ciprofloxacin, have shown limited effectiveness. The results of studies investigating the antibacterial activities of various antibiotics against *P. vulgaris* highlight the need for continued research in this area. It is important to understand the effectiveness of different antibiotics against *P. vulgaris* to help guide the selection of appropriate treatment options and reduce the development of antibiotic resistance.

CONCLUSIONS

The results of this investigation showed a higher prevalence of antibiotic resistance in P. vulgaris. The most effective antibacterial agents against P. vulgaris infections were Linezolid, Imipenem, Amikacin, and Gentamycin.

Conflicts of Interest

The authors declare no conflict of interest.

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