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Phenotypic Discrimination of Antibiotic Resistance Among P. Aeruginosa Collected from Burn Sample

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Abstract

Pseudomonas aeruginosa is characterized by that it is associated with many morbidities and deaths for people with immunodeficiency, as well as people who visit hospitals frequently and patients with burns, especially severe ones, because the bacteria are Gram-negative, opportunistic, and cause severe infections. The study included 45 samples that isolated the advanced aeruginosa bacteria from moderately burned men and women, their ages ranged between 12 to 60 years. The purpose of the study was to investigate the susceptibility of P. aeruginosa to resistance to some antibiotics for the purpose of controlling the incidence of wound infection in patients with burns. The phenotypic pattern of the bacteria under study shows that there is severe resistance to some antibiotics, while the bacteria are unable to resist some other antibiotics.

Introduction

Pseudomonas aeruginosa is characterized by that it is associated with many morbidities and deaths for people with immunodeficiency, as well as people who visit hospitals frequently and patients with burns, especially severe ones, because the bacteria are Gram-negative, opportunistic, and cause severe infections (1,2,3). This type of micro-organisms has the ability to withstand harsh growth conditions represented by few nutrients and high humidity, in addition to its ability to resist many antibiotics and sterilizers, and this explains the large number of its presence in medical equipment and devices and the keyboard of computers as well as in medicines and medical preparations (4,5). Pseudomonas aeruginosa in the burn center is considered one of the most common bacteria that causes transmissible diseases (nosocomial), and clinical isolates and isolates from the hospital environment contribute greatly to the spread of resistance against antibiotics as well as the ability to form biofilms (6). Therefore, it has become a source of great concern in all medical societies of the world, as it has caused the emergence of new resistant strains as a result

of the excessive use of antibiotic treatments in the burn halls. This is one of the reasons why the Nosocomial Infection made Pseudomonas aeruginosa use various means that make them able to resist the large variety of antibiotics, as they contain multiple enzymes that work to inhibit the action of antibiotics such as carbapenems and also beta-lactams (7,8). P. aeruginosa depends on several virulence factors for its pathogenesis (9,10,11). in addition to its ability to form biofilms. These biofilms reduce the efficiency of treatment against bacteria, as it helps in chronic infection (12). The presence of biofilms keeps these bacteria from drying out and helps them stick to the membranes, which reduces the effect of the body's immune defense mechanisms (13). There are several reasons for the spread of P. aeruginosa, including the contamination of the environment of the patient lying in the hospital, where he can become infected through the medical staff infected with this type of bacteria or through infected visitors, and the hospital environment may contain strains that are multiple drug resistance(MDR) and thus be a source of crosstalk for the spread of infection (14,15). The incidence of P. aeruginosa in patients with burns, especially severe ones, ranges from acute to chronic injury (16) and the percentage in which these bacteria spread ranges from 33% in all types of burns to 59% in burns of high severity and the difficulty and sensitivity of patients with severe burns makes the process of treating them difficult, which results in them having great complications (17). Therefore, P. aeruginosa infection has been reported in many hospitals (18,19). Patients with moderate and severe burns and those suffering from P. aeruginosa infection are considered a special cases illness because this type of bacteria has the ability to acquire resistance to many classes of drugs, although these antibiotics are effective against many other bacterial species (20) Because it has developed itself for high resistance against efficient classes of antibiotics (24,25). As they use defensive methods that include changing the target sites for drug action or lowering the concentration of the antibiotic or by applying the antibiotic by the action of the enzymes they use as virulence factors (23). Therefore, P. aeruginosa is known as an MDR for one or more types of antibiotics that are usually used against it (25). Moreover, the multiple drug resistance is caused by many factors, including the occurrence of genetic mutations in the genetic structure of bacteria or increased efflux, as well as horizontal gene transfer, which leads to limiting the action of the antigens used intravenously, such as imipenem and aminoglycosides (26,27).

Materials and Methods

Diagnosis of P. aeruginosa

The current study includes 60 samples of patients suffering from moderate and severe burns lying in the burn halls, and they have signs of sores and wounds. Swabs were taken from these prominent wounds using TSP transport medium, and then the nutrient media was inoculated such as blood agar and McConkey agar within two hours from taking swabs for the purpose of primary isolation, the P. aeruginosa bacteria were then placed in an incubator at a temperature of 37° C for 16 to 24 hours after the incubation process. Standard methods were used in bacteriology for the purpose of

distinguishing bacteria, then the bacteria were cultured in new cultures to obtain high purity of the bacterial culture, and then a test for sensitivity to antibiotics was conducted (22).

Susceptibility to antibiotics test

The antibiotic sensitivity test was conducted according to what was agreed upon in the Clinical Laboratory Standards Institute, (CLSI) (21). The use of antibiotic tablets is following a company.

Result

P. aeruginosa bacteria were isolated from 45 patients out of a total of 60 patients with moderate or severe burns lying in the burn hall. A sample consisted of 30 males and 15 females, their ages ranged from 12 to 60 years. Resistance to antibiotics ranged from highest to lowest resistance as follows: Timentin (ticarcillin/clavulanate), meropenem (MEM), ceftazidime (CAZ), imipenem (IMP), amikacin (AMK), Colistin and polymyxin B while the sensitivity to antibiotics was ranked from highest sensitivity to lowest sensitivity as follows: polymyxin B (PB), Colistin, amikacin, imipenem, ceftazidime, meropenem and Timentin as in table (1).

Table (1): resistance and sensitivity of p. aeruginosa to some antimicrobial agents.

Type Of Antibiotic	Number Of Resistant Samples / %	Number Of Sensitive Samples / %
Timentin	**30 (66.6 %)**	**15 (33.3 %)**
Meropenem	**28 (62.2 %)**	**17 (37.7 %)**
Ceftazidime	**25 (55.5 %)**	**20 (44.4 %)**
Imipenem	**22 (48.8 %)**	**23 (51.1 %)**
Amikacin	**16 (35.5 %)**	**29 (64.4 %)**
Colistin	**2 (4.4%)**	**43 (95.5 %)**
Polymyxin B	**Zero(0 %)**	**45 (100 %)**
Total	**45 Samples**	**45 Samples**

Discussion

Increased rates of mortality and health-acquired morbidity are strongly correlated with P. aeruginosa (28). This danger lies in the fact that this causative agent is the source of infection in patients with burns this is because of its effective ability to form a biofilm, which helps it to resist many antibiotics, which allows it to grow in very harsh conditions, despite sometimes the use of

antibiotics against it or its resistance to the surrounding conditions The process of biofilm formation is one of the most important virulence factors possessed by Plasmodium aeruginosa (29 ,30). There is a significant difference between the biofilm formation process and the MDR phenotype (31,32,33). Recent studies have recorded that the MDR phenotype of P. aeruginosa bacteria ranges from 4 to 60% of the infection rate that spreads in hospitals around the world (34,35). The current study is consistent with () which identified a group of antibiotics, including the study that P. aeruginosa is resistant to, as well as the high sensitivity of polymyxin, indicating that bacteria cannot resist this type of antibiotic (36). P. aeruginosa deactivates carbapenems and beta-lactams, by using ESBL (extended spectrum beta lactamases) and MBLs(metallo-β-lactamases), which are defense mechanisms used by bacteria that are resistant to many antibiotics that are considered to be One of the important means in the process of resistance against these antibiotics (8). Another innate defense used by P. aeruginosa is its expression of a multi-therapeutic efflux system due to reduced permeability of the outer membrane in bacteria. The chromosomal factors as well as the plasmid increase the resistance of P. aeruginosa to antibiotics with high efficiency, such as imipenem and ceftazidime, while it was found that the bacteria have low or may not be resistant to some antibiotics such as (37) The lower respiratory tract is one of the most common sources of P. aeruginosa infection, as well as the main reason for the phenomenon of multidrug resistance and recurrent bacteremia, especially when the source of infection is wounds. Thus, the incidence of resistance in some strains against the antibiotic ceftazidime is related to resistance to the antibiotic gentamicin, while Resistance of some strains of P. aeruginosa to meropenem is associated with resistance to the antibiotic amikacin (38).

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