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Antibiotic Susceptibility and Resistant Pattern of Isolates of *Pseudomonas aeruginosa* recovered from Infected Swabs, Abscess, Burn, Medical Tips and Blood from Patients at 4 Geographical Locations in Libya (Al- Bayda, Shahat, Derna and Benghazi)

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A B S T R A C T

Pseudomonas aeruginosa are associated with large number of identified infections. Rise in multidrug resistance among clinical isolates. A total of 342 specimens were collected from swabs (pus, blood, burn, exudate, tip and scalp specimen) and obtained during 12 months (January 2017-December 2017). The Majority of *P. aeruginosa* were isolated from swab specimens accounted217 (99%). The male to female were 241 (70%) to 101 (30%) respectively. *P. aeurginosa* showed a high susceptibility rate toward colistin, followed by ciprofloxacin while the high resistant rate toward Augmentin followed by Doxacillin. No statistically significant effect on the killing by drugs and the age, while had statistically significant effect on the pseudomonas infection and the gender. Benghazi, the highest area recorded the isolated pseudomonas (56%) followed by Albayda 61(18%). The antimicrobial agents are losing their efficiency because of the extent of resistant organisms due to unselective use of antibiotics, patient nonconformity and unhealthy condition.

Introduction

Pseudomonas aeruginosa is an opportunistic pathogen, abundant non-fermentative gram negative bacteria, the species of which are metabolically diverse capable of infecting virtually all tissues and becoming a major cause of morbidity and mortality. It can persist in both community and hospital settings due to its ability to survive on minimal nutritional requirements and to tolerate a variety of physical conditions.[7, 8, 5]Antibiotic drug resistance in pathogenic organisms is a worldwide problem now with severe treatment matters. [1, 2, 3]Agradual increase in drug resistance has been detected in most of the gram negative bacterial species, the main reason being extreme frequent use of antimicrobial agents. Popular of *Pseudomonas* species develop resistance to penicillin and other related beta-lactam antibiotics.[8] These opportunistic pathogens are host to numerous inherent and acquired resistance genes which they can also exchange with other gram negative bacteria.[9]*P. aeruginosa* has high environmental tolerance, and inherent resistance to antimicrobial agents through a variety of mechanisms as decreased impermeable outer membrane, efflux systems which actively pump antibiotics out of the cell, and production of antibiotic-inactivating enzymes, forms biofilms and has a several siderophores and pigments that tolerate it to escape the innate immune system.[1] *P. aeruginosa* is the second most common cause of nosocomial pneumonia (17%), the third most common cause of urinary tract infection (7%), the fourth most common cause of surgical site infection (8%), the seventh most frequently isolated pathogen from the bloodstream (2%) and the fifth most common isolate (9%) overall from all sites.[1] Mechanisms that cause antimicrobial drug resistance due to acquisition of resistance genes (e.g those encoding beta-lactamase and amino-glycoside modifying enzymes.[5]

Ongoing studies on current antimicrobial resistance profiles of *P.aeruginosa* are essential to find out the susceptibilities and resistant pattern of this species isolated from clinical samples. The present study aimed to investigate the incidence and antibiotic susceptibility of *P. aeruginosa* in various eastern cities in Libya including Benghazi, Al-bayda, Shahat and Derna hospitals and privet laboratories.

Gessard first got *P. aeruginosa* in pure culture in 1882 from cutaneous lesions.[22] Common of *P. aeruginosa* strains release at least two colors.[23]. Neutropenia patients are mainly susceptible to pseudomonas infection and to consequent septicemia.[6]The use of broad-spectrum antibiotics may kill commensal flora or more antibiotic-sensitive pathogenic species causing infection, and backing colonization by the resistant pseudomonas. *P aeruginosa* is mostly related with progressive and finally lethal chronic respiratory infection in cystic fibrosis.Other two pseudomonas species, which cause disease in humans. *P.Burkholderia* is a remote relation of *P. aeruginosa.* It is all over the environment and is normally found in the water, soil and plants. *P. aeruginosa* can cause disease in immune compromised people, and it has been known as a highest pathogen in cystic fibrosis.[15]

Materials and Methods

This is the first study was performed in eastern parts of the country including Benghazi, Albayda, Shahat and Derna hospitals- and privet laboratories and was carried out in the Department of Microbiology laboratories during the period of 12 months, from (January 2017- December 2017). Different samples were tested for *P. aeruginosa* growth from342 patients, which were 241 (70%) males and females 101 (30%). All clinical isolates were sub cultured on blood agar, chocolate agar, Macconky agar, s s agar and CLED agar and

nutrient agar then incubated at 37Co for 16-24 hours. After obtaining the pure strains, the strains were subjected to biochemical identification tests to identify *P. aeruginosa*.

For this purpose, samples were inoculated in Triple Sugar Iron media (TSI), Citrate media and kept in an incubator for 18 hrs at 37°C. Antimicrobial susceptibility testing of each *P. aeruginosa* isolate was performed using Kirby Bauer disk diffusion method.

Results and Discussion

The data was analyzed using Microsoft Excel2010 software.

Distribution of isolated *P. aeruginosa* according to the gender

Total of (342) samples subjected to culture and sensitivity and reported the presence of *P. aeruginosa*. Therefore were reported from males and females of whom (342), 241 (70%) were males while female accounted 101 (30%) respectively (Table 1 and Fig. 1).

Distribution of Pseudomonal growth according to the specimens. The highest specimen that enrolled with *P. aeruginosa* was recorded in swab 339 (99%) followed by Blood 3 (1%) (Table 2).

Distribution of *Pseudomonas* growth according to the area

Benghazi (56%) was the highest area that record the isolated of Pseudomonas growth in the specimens, followed by Al baida 61 (18%) and Morzoq 13 (4%) (Table 3).

Susceptibility and resistant patterns of *P. aeruginosa* to antibiotics

The highest susceptibility of antibiotic toward *P. aeruginosa* was colistin 294 (86%) followed by ciprofloxacin 185 (54%) and amikacin132 (39%). While the highest resistant was observed toward Tetracycline 291(85%) followed by Septrin 272 (82%) and Doxacilin 222 (56%) (Fig. 2).

Distribution of pseudomonas growth according to age

Most of them belonged to the age group 21-30 (117, 34%), followed by patient of 31-50 (76, 22%) years of age while he lowest was recorded in age group 1day-9 years (Table 4).

Total of 342 samples subjected to culture and sensitivity, 206 specimens report the presence of *P. aeruginosa*. The most common incidence rate was from male 241 (70%) than female 101 (30%). this result similar with Josef Yayan *et al.,* [11]Rajat Rakesh *et al.,*[13] Javiya *et al.,*[14]Jamshaid Ali Khan *et al.,*[16] Rashid *et al.,*[17], Qari and Akbar[19] As shown in the study can be explained by the fact that in our country males are exposed more to the outside environment because of their mobility as compared to females. In our study, the male was more susceptible to the antimicrobial agents than females this is comparable with studies conducted by Malikunnisa and Begum[18].

Chennai have shown that males were more susceptible than females in the ratio of 8:3. Colistin followed Cip was the most susceptibility antibiotic to *P. aeruginosa* in both gender. The minimum age enrolled in the study was 1 day and maximum age was 87 years. A study that conducts by Ahmed OB. [10] was agreement with our study when observed a high susceptibility of *P. aeruginosa* was recorded toward colistin. Imipenem was the most effective with highest sensitivity of (99.5%) followed by ciprofloxacin (97.5%). A study in Saudi Arabia by Siva Gowri *et al.,* [12] also showed 85% of the *P. aeruginosa* isolates sensitive to ciprofloxacin.

Table.1 Distribution of the patients according to the gender

Gender	Male	Female
%	70%	**30%**
Number	241	**101**

Table.2 Distribution of pseudomonas growth according to the specimens

sample	blood	swab	%
Pseudomonas growth	3 (1%)	339 (99%)	**100%**

Table.3 Distribution of Pseudomonas growths according to the area

City	seudomonas growth	City	Pseudomonas growth
Benghazi	13 (4%)	Ejdabya	221 (65%)
Albayda	2 (1%)	Martoba	61 (18%)
Solog	2 (1%)	Algigab	4(1%)
Alabraq	13 (4%)	Morzoq	2(1%)
Jalow	3 (1%)	Almareej	4(1%)
Sabha	2 (1%)	Agoba	4(1%)
Tobroq	1 (1%)	Albareega	4(1%)
Jardas	1 (0%)	Alabyar	1(0%)
Derna	2 (1%)	Shhat	2(1%)

Table.4 Distribution of *Pseudomonas* growths according to age

Age	87-51 year	50-31 year	30-21 year	20-1 2 year	1day-9 year	Total
Number	66 (19%)	76 (22%)	117 (34%)	52 (15%)	31(9%)	**342**

Fig.1 Distribution of isolated *P. aeruginosa* according to the gender

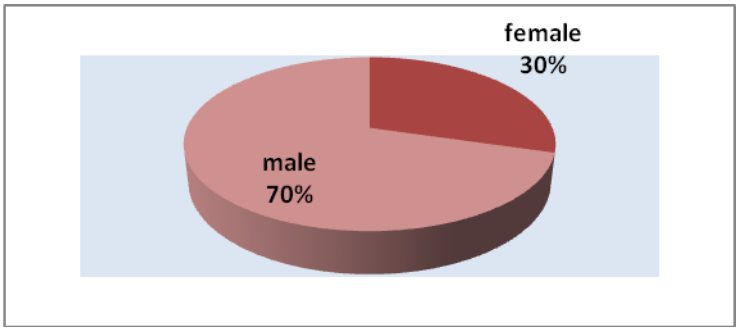
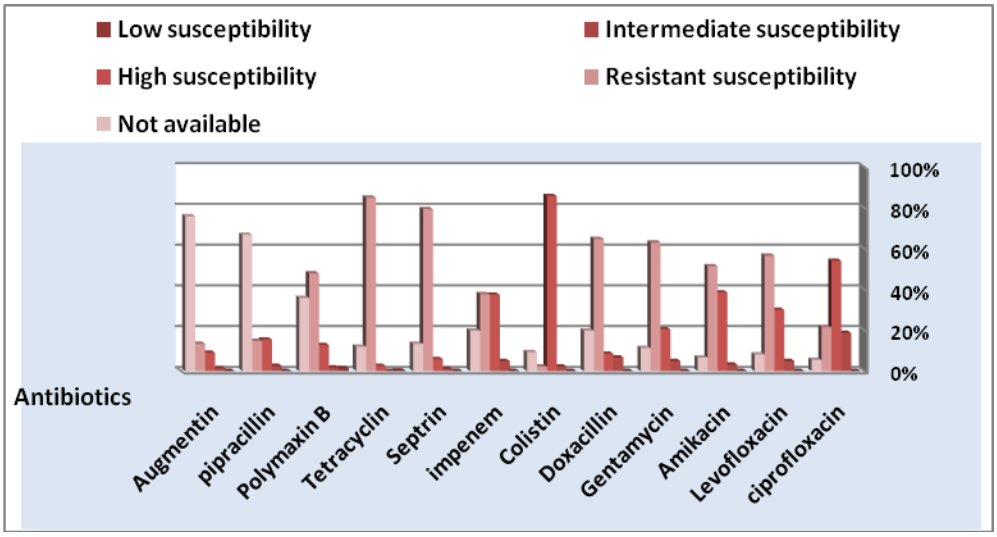


Fig.2 Susceptibility and resistant patterns of *Pseudomonas aeruginosa* to antibiotics



The data of the present study showed higher level of susceptibility to colistin and ciprofloxacin than septrin and Augmentin which may reflect the increased use of Septrin and Augmentin and the decreased use of colistin and ciprofloxacin in recent years in this area. The present study showed a very low colistin resistance rate (12.6%) against *P. aeruginosa*. Although resistance to colistin is generally rare, it is higher in the Mediterranean and South-East Asia (Korea and Singapore).[20] Colistin is not preferred due to its nephrotoxicity. It remains one of the last-resort antibiotics for multidrug-resistant.[21]The present study recorded, the high resistant rate toward the highest resistant observed toward Tetracycline 291(85%) followed by Septrin 272 (82%) and Doxacilin 222 (56%). As expected, the strains were resistant to these antibiotics indicating the emergence of multidrug-resistant strains. Similar to our study, Walaa M. Saeed *et al.,* [15] that reported the most resistant drugs included Augmentin (25%). In contrast of our result Josef Yayan *et al.,* [11] reported the resistance pattern was seen with ciprofloxacin, levofloxacin, Piperacillin and Imipenem, while Malikunnisa and Begum.[16] reported the strains were resistant to imipenem and Rajat Rakesh *et al.,*[13] reported the most resistant antibiotic was gentamycin (63%).[5] The highest isolated of *P. aeruginosa* from specimens according the area, Benghazi recorded (56%) followed by Albaida 61(18%) and Morzoq13 (4%). In present study the prevalence of infection was higher in were isolated from swab 339 (99%).samples.

In present study, there is distinct difference in the sensitivity pattern of isolates of *Pseudomonas* spp from specimen to specimen.

This is agreement with Rajat Rakesh *et al.,*[13] The antimicrobial agents are losing their efficiency because of the extent of resistant organisms due to unselective use of antibiotics, lack of mindfulness, patient no obedience and unsanitary condition.

Colistin was found to be the most active antimicrobial agent, followed by Ciprofloxacin for the treatment of pseudomonas infection. One of reasons of high susceptibility to Colistin because it is not available use in Libya like other drugs and not recommended for treatment because have

nephrotoxicity. It is expected that Colistin will have essential and reliable role as future antibiotic for treatment of multi-resistant Gram-negative infections and as an alternative of antibiotics that have been available so far. Continuous checking of antimicrobial susceptibilities at each hospital is important to help in deciding the most suitable therapy for *P. aeruginosa* infection and to know the increasing resistance pattern.

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