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ISOLATION AND ANTIBIOTIC SUSCEPTIBILITY TEST OF PSEUDOMONAS MEMBERS IN THE PUS / WOUNDS INFECTIONS BY UTILIZING VITEK2 SYSTEM IN DUHOK CITY

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ABSTRACT

The aim of this study was to determine the rate of Pseudomonas species involved in wound infections. Also, the susceptibility and resistotyping patterns of the isolates to commonly prescribed antibiotics were also studied. During a period of nine months between March and November, 2022, a total of 200 specimens of pus or wound swabs were collected from adults patients that went to the Vin and Emergency Hospital in Duhok City. The samples were plated on Blood agar and MacConkey Agar, and the isolates were identified by the VITEK2 System. Antibiotic susceptibility and resistance profiles for 20 commonly prescribed antibiotics were also performed by the VITEK2 System. Out of the 200 samples collected from wound infections, 43 isolates of Pseudomonas species were identified at a rate of 21.5 % ***Pseudomonas aeruginosa*** **being more common than the other species, which included 33 isolates (77 %), flowed by 7** ***P. putida*** **isolates (16 %), and 3** ***P. fluorescens*** **isolates (7 %). All isolates were obtained from adult patients aged 16–75 years, 29 (77%) of them were isolated from males, while 14 (33%) were isolated from females. The sensitivity patterns showed that Amikacin and Piperacillin-Tazobactam were the most active antibiotics against** ***Pseudomonas aeruginosa,*** **followed by Piperacillin, and then Colistin with Tobramycin. The Meropenem and imipenem show a high level of activity against** ***P. putida*** **and P.** ***fluorescens*** **isolates, while their sensitivity was moderate for** ***Pseudomonas aeruginosa*****. Also, moderate sensitivity was revealed by Ciprofloxacin, Levofloxacin, and Ceftazidime, while all isolates were resistant to the Cefixime, Ceftriaxone, Cefazolin, Co-Trimethoprim, Amoxiclav, and Amoxiclav, and low sensitivity to Cefepime.**

KEYWORDS*:* Pseudomonas members, wound infections, antibiotic susceptibility test

INTRODUCTION

Pseudomonas genus include more than 140 species, which mostly are saprophytic, more than 25 species of them are associated with humans (Gravningen K, 2022). Most pseudomonads family known to cause disease in humans are associated with opportunistic infections, These include *P. aeruginosa, P fluorescens, P. putida, P. cepacia, P. stutzeri, P. maltophilia,* and *P. putrefaciens* (Huang *et al.,* 2018)

Pseudomonas bacteria are Gram-negative, aerobic, and motile by a single polar flagellum (Vijeta, 2022). Although this bacteria rarely causes disease in the healthy peoples, but it regarded as a major threat to hospitalized and immune comprised patients, particularly those with serious underlying illnesses such as burns, wounds, cancer and other critical disease (Huang *et al.,* 2018)

In the Pseudomonads family, the species *Pseudomonas aeruginosa* (*P. aeruginosa*) has emerged as a major cause of Gram-negative infections, especially in immunosuppressed patients. It is the most frequent pathogen to be found in patients who have spent more than a week in the hospital, and it found in numerous causes nosocomial infections (Felipe *et al.,* 2022). Due to its clinical importance, *P. aeruginosa* is regard the most important, common pathogen in humans and most of the studies were done among this species more than other species of this genus. In contrast to the *P. aeruginosa*, the other members of Pseudomonas like *P. putida* and *P. fluorescens* are less virulent and are found in the environment, and even that they can still cause illnesses and serve as opportunistic pathogen (Obritsch *et al.,* 2004).

Pseudomonas putida strains are common in soil and water but also have been reported as human opportunistic pathogens that capable of

causing nosocomial infections (Walker *et al.*, (2004). Despite the fact that *P. putida* may cause infections, clinical data on infections cause by this species are scarce; this is likely due to the rarity, relatively lower virulence and higher antimicrobial susceptibility compared to *P. aeruginosa* (Yoshino *et al.*, 2011).

Another member of Pseudomonas group which is a commensal bacterium known as *Pseudomonas fluorescens*, this organism has been found in a variety of clinical samples, including blood, urinary tract, skin, and lung. Furthermore, they are occasionally linked to acute opportunistic infections. They are also present in the human digestive tract at low levels (Feuilloley *et al.*, 2013).

Pseudomonas members especially *P. aeruginosa* can cause various diseases localized infection, post operation and burns infections which may results in a fatal bacteremia. Moreover, this opportunistic pathogen is capable of infecting virtually all tissues, but the wound infections, pneumonia and urinary tract infections are predominate (Lister, 2009; Kalluf, 2017). This bacterium is regard one of the most common bacterial species that can be detected in wounds (Felipe *et al.*, 2022; Rahim, 2017). Most strains of Pseudomonas bacteria can produce one or more pigments, but the most common one is the pyocyanin (Church, 2006). This pathogen mostly affect the patients with immunocompromised due to its ability to evade both acquired defenses and innate immune through many virulence factors like adhesion, colonization, and biofilm formation and also by producing many factors that cause significant tissue damage (Turkina, 2019).

Factors that produces by *P. aeruginosa* which share in their virulency include endotoxins with exotoxins, and almost all strains of *P. aeruginosa* can produces hemolytic activity on blood agar with several different types of hemolysins (Kysar, 2005).

Wounds containing *Pseudomonas* are frequently more complex and take prolonged time to heal than non-Pseudomonas-containing wounds (Brandenburg, *et al.*, 2015; Wolcott *et al.*, 2016). *P. aeruginosa* is an invasive organism that often causes severe tissue damage in the wounds infections and ulcers (Kalluf *et al.*, 2017). Pseudomonas bacteria are capable of adapting to changes in the environment, rapidly developing resistance to antibiotics, and producing a variety of virulence factors, and all these factors make this bacterium to be more complex in the wounds and other infections (Ito*et al.*, 2021).

Wounds that infected with Pseudomonas may present with a greenish crust and malodorous, or may emit a characteristic sweet odor (Mutluoglu, 2011). These characteristics of pyocyanin are partly responsible for the blue–green pigment (Lau, 2004). However, in many wounds with Pseudomonas infection, these symptoms may be not observed (LE *et al.*, 2020).

Pseudomonas have a high resistance to the antimicrobial agents, and also have a notable ability to withstand disinfectants, they have been found growing in hexachlorophene-containing soap solutions, in antiseptic and in detergents (Silverio, 2022). It also exhibits a high degree of resistance to a variety and broad spectrum of antibiotics including beta lactams and this regard a major problem in Pseudomonas infections (Yezli, 2014; Lee, 2003).

Pseudomonas resistance to various antibiotics must be continuously monitored in order to observe trends in susceptibility patterns and properly direct treating physicians when selecting empirical therapy, particularly when new antibiotics may not be readily available in the near future (Siva, 2009).

To the best of our knowledge, there are only limited surveillance studies among clinical isolates of Pseudomonas members, and most studies in our region focus on *P. aeruginosa* only and don't highlight other species of this genus such as *P. pudida* and *P. fluorescens*.

Therefore, the aim of the present study was to find out by using of VITEK2 system, the rate of Pseudomonas members in pus/wounds infections and to evaluate the current levels of antibiotic susceptibility of this bacterium, as well as assess the resistance pattern of anti-pseudomonal antibiotics among the clinical isolates of Pseudomonas members isolated.

MATERIALS AND METHODS

Collection of Pseudomonas species isolates

From March to November 2022, a total of 200 pus/wound swab specimens were collected from adult's patients that went to the Vin and Emergency Hospital in Duhok City.

Specimens were collected aseptically from infected wounds using a sterile cotton swab or by withdrawing pus with a syringe by needle aspiration, and all specimens were immediately transported to the Microbiology Department at VIN Hospital and processed.

Bacterial Identification

All obtained specimens were cultured on different media, such as Blood agar, MacConkey agar. The plates were incubated aerobically at 37ºC for 24 hours.

Suspected colonies of Pseudomonas were identified on the basis of colonial morphology, Gram stain, and biochemical tests. Non-lactose fermented colonies on MacConkey's agar were selected and sub cultured to obtain pure culture. The morphological and biochemical characteristics of the growing colonies, including size, shape, color, pigmentation, odor, and positive reactions to the catalase and oxidase tests, were recorded. All of the media and reagents were obtained from (Difco, United States). The species of Pseudomonas were confirmed and differentiated using the VITEK 2 Compact System with a Gram-negative detection kit (GN-69 BioMérieux, France), which employs for identification, the fluorogenic methodology.

Antibiotic Sensitivity testing

The VITEK 2 system with a Gram negative susceptibility card (AST - N 326 BioMérieux, France) was used to perform the antibiotic susceptibility pattern of Pseudomonas species isolates.

RESULTS

Identification of Pseudomonas isolates

From March to November, 2022, a total of 200 Pus/wound samples were collected from VIN and Emergency Hospital, 43 isolates of Pseudomonas isolates were identified with the rate of 21.5% in all samples, which include 33 of *P.aeruginosa* (77%) , 7 of *P. putida* (16%) and 3 of *P. fluorescens* (7%) (Table 1)

Isolate distribution indicated that all isolates were obtained from adult patients aged between16 –75 years, 29 (67%) of them were isolated from males while 14 (33%) isolates were isolated from females.

Table (1): The rate of Pseudomonas species isolated in this study.

***Pseudomonas* species**	**Number of isolates**	**Percentage out of 43(%)**
Pseudomonas aeruginosa	**33**	**77**
Pseudomonas putida	**7**	**16**
Pseudomonas fluorescens	**3**	**7**
Total	**43**	**100**

Antibiotics sensitivity patterns

The sensitivity patterns of 33 *P. aeruginosa* isolates are shown in Table 2. The organism was most sensitive to Amikacin and Piperacillin-Tazobactam, followed by Piperacillin, and then by Colistin with Tobramycin, and finally by Meropenem, and Imipenem. The results alsoshowed a moderate sensitivity to Ciprofloxacin and Ceftazidime, and all isolates were resistant to Cefixime, Ceftriaxone, Cefazolin, Co-Trimethoprim, and Amoxiclav, with a low sensitivity rate to Cefepime (Table 2).

Table (2): Susceptibility test of (33) *Pseudomonas aeruginosa* isolate

Antibiotics	Concentration (µg)	Sensitive No. (%)	Resistant No. (%)	Intermediate No. (%)
Amikacin	10	31 (94)	2 (6)	0
Amoxiclav	30	0	33 (100)	0
Cefuroxime	30	0	33(100)	0
Cefazolin	30	0	33(100)	0
Ceftazidime	30	15 (46)	18 (54)	0
Cefepime	30	12 (37)	21(63)	0
Cefixime	30	0	33	0
Ceftriaxone	30	0	33	0
Cefoxitin	30	0	33	0
Levofloxacin	10	18 (54)	12 (37)	3 (9)
Ciprofloxacin	10	17(51)	15 (46)	1 (3)
Imipenem	10	21 (63)	12 (36)	3 (9)

Meropenem	10	23 (70)	10 (30)	3 (9)
Colistin	150	25(76)	8 (24)	0
Piperacillin	100	30 (90)	1	2
Piperacillin /Tazobactam	100	31 (94)	1	1
Co-Trimethoprim	30	0	33 (100)	0
Tigecycline	50	2 (7)	30 (90)	1(3)
Tobramycin	15	24 (72)	9 (28)	0
Gentamycin	15	22 (67)	10 (30)	1(3)

The sensitivity patterns of *P. putida* isolates was showed that all isolates of this species are sensitive to Meropenem, imipenem, and Amikacin (Table 3). They were appeared to be high sensitive to Colistin, Tigecycline, Piperacillin/Tazobactam, and Piperacillin, and moderate sensitivity to Tobramycin, Gentamycin, Ciprofloxacin, Levofloxacin, Ceftazidime. However, all isolates were resistant to the Amoxiclav, Cefixime, Ceftriaxone, Cefazolin (Table 3).

Table (3): Antibiotics usceptibility test of *P. putida* isolates (N=7)

Antibiotics	Concertation *(µg)*	Sensitive No. (%)	Resistant No. (%)	Intermediate No. (%)
Amikacin	10	7 (100)	0	0
Amoxiclav	30	0	7(100)	0
Cefuroxime	30	0	7(100)	0
Cefazolin	30	0	7(100)	0
Ceftazidime	30	4 (57)	2 (29)	1(14)
Cefepime	30	2	4	0
Cefixime	30	1(14)	5	1(14)
Ceftriaxone	30	0	7(100)	0
Cefoxitin	30	0	7(100)	0
Levofloxacin	10	4	3 (43)	0
Ciprofloxacin	10	3(43)	3(43)	1(14)
Imipenem	10	7(100)	0	0
Meropenem	10	7(100)	0	0
Colistin	150	6 (86)	1(14)	0
Piperacillin	100	5 (71)	2 (29)	0
Piperacillin /Tazobactam	100	6 (86)	1(14)	0
Co-Trimethoprim	30	0	7(100)	0
Tigecycline	50	5 (71)	1(14)	1(14)
Tobramycin	15	5 (71)	2 (29)	0
Gentamycin	15	4 (57)	2(29)	1(14)

The results of antibiotic sensitivity patterns of *P. fluorescens* isolates are shown in Table 4. Because only three isolates of this species were detected in this study, the results may not reflect the true and accurate sensitivity patterns, but even so, the three isolates of this species revealed a high sensitivity to the antibiotics Amikacin, Imipenem, Meropenem, Colistin, Tigecycline, and Piperacillin-Tazobactam. The isolates were not responded to the Co-Trimethoprim, Amoxiclav, Cefixime, Ceftriaxone and Cefoxitin, and they had moderate sensitivity to the Ceftazidime, Ciprofloxacin, Levofloxacin and low sensitivity to the, Piperacillin.

Table (4): Antibiotics susceptibility test of *Pseudomonas fluorescens* isolates (N=3)

antibiotics	Concentration (µg)	Sensitive No. (%)	Resistant No. (%)	Intermediate No. (%)
Amikacin	10	3 (100)	0	0
Amoxiclav	30	0	3(100)	0
Cefuroxime	30	0	3(100)	0
Cefazolin	30	0	3(100)	0
Ceftazidime	30	2(67)	1(33)	0
Cefepime	30	0	3(100)	0
Cefixime	30	0	3(100)	0
Ceftriaxone	30	1(33)	2(67)	0
Cefoxitin	30	0	3(100)	0
Levofloxacin	10	2(67)	1(33)	0
Ciprofloxacin	10	1(33.4)	1(33.3)	1(33.3)
Imipenem	10	3(100)	0	0
Meropenem	10	3(100)	0	0
Colistin	150	3(100)	0	0
Piperacillin	100	1(67)	0	1(33)
Piperacillin /Tazobactam	100	3(100)	0	0
Co-Trimethoprim	30	0	3(100)	0
Tigecycline	50	3(100)	0	0
Tobramycin	15	2(67)	1(33)	0
Gentamycin	15	1(33.3)	1(33.3)	1(33.3)

The rate of resistance patterns of all Pseudomonas isolates is shown in Table 5. As shown in the table, all 43 isolates of this bacterium were resistant to at least 7 types of antibiotics and2 of them were resistant to the 19 different types of antibiotics, while the remaining isolates, which include 27, 21, 15, 8, 5, 3, and 3 isolates, were resistant to the 8, 9, 11, 12, 13, 14, and 17 types of antibiotics, respectively.

Table (5): The Rates of resistance patterns of the Pseudomonas isolates

No. of Drug Resist	No. of isolates (N = 43)	Percentage (%)
>= 7	**43**	**100**
>= 8	**27**	**62**
>= 9	**21**	**49**
>= 11	**15**	**35**
>= 12	**8**	**18**
>= 13	**5**	**11**
>= 14	**3**	**6**
>= 17	**3**	**6**
>= 19	**2**	**4**
>= 20	**0**	**0**

DISCUSSION

Pseudomonas bacteria, particularly the species aeruginosa, have become an important cause of Gram-negative wound infections and can cause major problems, particularly in pus and wound infections, which are regarded as one of the world's important health problems (Lee, 2003; Yezli, 2014). The wounds regard a good site for colonization the opportunistic microorganisms including Pseudomonas bacteria (Tredget, 2004).

Pseudomonas aeruginosa isolates were the most prevalent species among the Pseudomonas isolates in this study, followed by *P. putida* and then *P. fluorescens* isolates. The results were

consistent with other studies that found Pseudomonas species, particularly *P. aeruginosa*, to be among the most common and important infective organisms in wound infections (Naser *et al.*, 2003; Ahmad, 2020).

The predominant presence of *P. aeruginosa* isolates among other species of Pseudomonas is due to this pathogen being mostly related to human infections, in contrast, to other members of the genus Pseudomonas such as *P. putida* and *P. fluorescens*, which are mostly related to the environment. However, they can also act as opportunistic microorganisms in human infections. (Obritsch *et al.*, 2004)

This study showed that the infection rate by Pseudomonas among the males (67%) was greater than that among the females (33%). which agreed with a study conducted in India that showed that males were more infected by this bacteria than females in the ratio of 55 % to 45% (Bindu, 2022). Another study in India has shown that males were more susceptible than females in the ratio of 2 males to1 female) (Ranjan KP, 2010), which was in accordance with the current study. The males predominance over female patients in this study may 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.

With some variations among the Pseudomonas species, the antimicrobial sensitivity patterns of the Pseudomonas species in this investigation showed that the isolates demonstrate resistance to a number types of antibiotics as well as some rates of susceptibility to other types. Generally, it was found in this study that the isolates of *P. aregenosa* were more resistant than other species of Pseudomonas bacteria.For example, the sensitivity to Meropenem, Imipenem, and Tigecycline for the isolates of *P. putida* and *P. fluorescens* were more sensitive than the *P. aregenosa* isolates, which revealed only moderate sensitivity to both Meropenem and Imipenem and exhibited very low activity against Tigecycline. This may be due to the fact that *P. aregenosa* is more virulent among the other species and more known to cause diseases in humans (Silverio, 2022).

Amikacin, Piperacillin-Tazobactam, Colistin, and Piperacillin were discovered to be the most active antibiotics against all Pseudomonas species in this study, which agreed with Ahmad (2020).

Amikacin revealed the highest activity against Pseudomonas isolates obtained in the study, and our findings were almost similar to that reported by Javiya (2008) and also these results were similar with a report published in India (Smitha , 2005). However, this result was in disagreement with another study (Patzer, 2007), which the isolates revealed a high resistance to the Amikacin. This antibiotic seems to be a promising therapy for pseudomonas infection. Hence, its use should be restricted in our area to severe infections only, in order to avoid the rapid emergence of resistant strains. This antibiotic is a semi-synthetic aminoglycoside antibiotic derived from Kanamycin A and it is active against a broad spectrum of Gram-negative organisms, including *pseudomonas*, *Escherichia coli*, and some Gram-positive organisms such as *Staphylococcus aureus* (Poole, 2005)

Another very active antibiotic against Pseudomonas which was found in the result of this study was Piperacillin-tazobactam. Piperacillin-tazobactam which is a drug of choice for treating wounds infections caused by Pseudomonas species. This antibiotic is a beta-lactam-beta-lactamase inhibitor combination with a broad spectrum of antibacterial activity. Thus, it is one of the most antibiotic that is used for Gram-positive and Gram-negative aerobic bacteria as well as anaerobic bacteria, including many pathogens producing beta-lactamases such as Pseudomonas (Ahmed, 2020; Perry, 1999). Resistant to the Piperacillin-tazobactam and Piperacillin were relatively low and it was in agreement with a study conducted by Juayang (2017) and it has reported that only 25% of the isolates were Pipereacillin - tazobactam resistant. A similar pattern of sensitivity to Piperacillin- tazobactam was observed by various studies (Singh, 2017; Shah, 2015; Shikha, 2014; Thomas, 2016; Juayang , 2017). However, high pattern of resistance was noticed in a study conducted by Sangeeta (2017).

Although the Tigecycline antibiotic is regarded as one of the most broad spectrum antibiotics used for treatment of infections caused by Gram negative bacteria, it is usually used as a last resort for infections caused by multidrug-resistant and extensively drug-resistant Gram-negative bacteria, such as Enterobacterales and Acinetobacter spp (Silverio, 2022), but even that the isolates of *P. aregenosa* exhibit a high resistance to this antibiotic. On other hand, it was very active

against both *P. putida* and *P. fluorescens* isolates, which was also reported by Bassetti (2014).

Also from the results of sensitivity test, it was found that all isolates of pseudomonads species were revealed a very high resistance with rate 100 % to the several types of antibiotics including Amoxillin, Co-Trimethprim, Cefuroxime and Cefazolin, and they exhibit low rate of sensitivity to the other antibiotics such as Cefepime, Cefixime. Similar results were also reported and it has revealed that the Penicillins and Cephalexin has been no activity against Pseudomonas bacteria and they were highly ineffective against *P. aeruginosa* (Perry, 1999). However, at the same time, the isolates revealed a high sensitivity to the Ceftazidime, and this was also mentioned in a study done by Puri which reported that Ceftazidime and Cefoperazone were the two third generation cephalosporins with anti-pseudomonal activity (Puri, 1996).

The Carbapenems, which include Meropenem and Imipenem, had moderate activity against *P. aeruginosa* isolates, while both *P. putida* and *P. fluorescens* revealed a high sensitivity against this group of antibiotics with the rate of 100%. The resistance rate to Meropenem and Imipenem (30%, 36%) noted for *P. aeruginosa* isolates in this study was relatively high when compared to other studies (Singh, 2017; Shikha, 2014; Thomas, 2016; Juayang, 2017). This increased resistance is quite alarming, taking into account that Carbapenems are the last line of antibiotics for treating Gram-negative bacilli infections. The resistance to Carbapenems may be the result of the complex interactions of several mechanisms, including the production of Carbapenems, the overproduction of the efflux system, and the loss of outer membrane porins (Gupta, 2006; Navneeth, 2002; Yu, 2004).

Colistin antibiotic, which was approved for the treatment of acute and chronic infections caused by certain strains of Gram-negative bacteria, including Pseudomonas species, is also known as the "antibiotic of last resort" for the treatment of infections caused by multidrug-resistant Gram-negative bacterial pathogens (Paterson, 2016). The results of this study also showed that *P. aeruginosa* isolates revealed resistance against this antibiotic. Therefore, the use of colistin should be restricted and clinicians should avoid using it as initial empirical therapy. Both *P. putida* and *P. fluorescens* isolates revealed a high susceptibility to this antibiotic in this study.

For the remaining antibiotics in this study, there was a moderate level of activity from Ciprofloxacin and Levofloxacin against the Pseudomonas isolates, even though these two antibiotics remain an active choice for the treatment of Pseudomonas species.They seem to be suitable for single-drug treatment of *Pseudomonas aeruginosa* infections in patients with normal host defense mechanisms, while their therapeutic potential in compromised hosts requires further evaluation (Follath, 1986)

Finally the Drug resistance in Pseudomonas is a major clinical problem in treating infections caused by this organism and generally this bacterium is naturally and inherently resistant to many antimicrobial agents (Silverio, 2022). This was also appeared in the result of this study which confirmed by the result reported in Table 5, as it appears in this table that all isolates of this bacterium were at list resistant to 7 types of antibiotics and the resistance raised until reached to the 19 different types of antibiotics., It mentioned previously that the resistance of *P. putida & P. fluorescens* isolates were relatively less than *P. aeruginosa*, but they also revealed resistance to the many antibiotics. The utilizing of the quorum sensing system by this bacteria to strategically coordinate virulence and also the biofilm formation, with the synergy between multi-drug efflux system and low outer membrane permeability, all these factors make this bacterium more resistant to antibiotics (Brian , 2022). Many other studies revealed high resistance of Pseudomonas against many different types of antibiotics, such as a study done by Lima *et al*. (Lima *et al.,* 2015), which mentioned the Pseudomonas was resistance to most penicillins and to first- and second-generation cephalosporins (such as cefoxitin and cefuroxime). It has also been abservedin multidrug-resistant isolates belonging to both *P. putida* and *P. fluorescens* (Silverio, 2022; Allen, 2009).

In fact, over and inappropriate use of antibiotics is responsible for the development of resistance of Pseudomonas species to the antibiotics. In addition, the resistance patterns and isolation rates of *P. aeruginosa* varies regionally (Castillo et al., 2015). Hence, increasing importance has been placed on the careful monitoring of antimicrobial resistance patterns of *P. aeruginosa* isolates for appropriate empirical as well as targeted treatment.

Furthermore,, the antibacterial treatment strategies should focus on *P. aeruginosa*. Thus, the prevalence and resistance rates are increasing gradually. The use of Amikacin, piperacillin-tazobactam, ceftazidime, and colistin should be limited in terms of reservation to reduce the resistance of Pseudomonas, especially *P. aeruginosa*, to these antibiotics.

CONCLUSION

Pseudomonas species especially *P. aeruginosa* remains as a common wound's pathogen with rate of21 %). Drug resistant Pseudomonas strains are markedly high in our area. The most active susceptibility pattern was revealed by Amikacin, Piperacillin- tazobactam and colistin.for reducing the resistance of this bacterium, it should be emphasized that each institution should have an antibiotic policy based on the antibiogram which should be renewed yearly.

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اختبار العزل والمضادات الحيوية لأعضاء PSEUDOMONAS في إصابات القيح / الجروح عن طريق استخدام نظام VITEK2 في مدينة دهوك

الخلاصة

Pseudomonas ، وخاصة *Pseudomonas aeruginosa* ، هي كائن جائر يتسبب في كثير من الأحيان في تلف الأنسجة الشديد في الجروح والتهابات الحروق. *Pseudomonas aeruginosa* وأعضاء أخرى من عائلة ال (Pseudomonas) مثل *P. putida* و *P. fluorescens* هي من مسببات الأمراض الانتهازية التي يمكن أن تسبب التهابات حادة وشديدة. بشكل عام هذه البكتريا مقاومة للعديد من المضادات الحيوية ، مما يجعل علاج التهابات المتسببة بهذه البكتريا أكثر صعوبة.

هدفت هذه الدراسة إلى تحديد معدل أنواع Pseudomonas المشاركة في التهابات الجروح. كما تمت دراسة فحص الحساسية وأنماط مقاومة العزلات للمضادات الحيوية الشائعة.

خلال فترة تسعة أشهر من مارس إلى نوفمبر 2022 ؛ تم اخذ 200 عينة من مسحات الجروح من المرضى البالغين المراجعين إلى مستشفى فين الاهلي ومستشفى الطوارئ في مدينة دهوك. وتم زراعة العينات المأخوذة على أجار الدم وأجار ماكونكي ، وتم تشخيص العزلات بواسطة نظام VITEK2. كما وتم ايضا إجراء فحص الحساسية للمضادات الحيوية لـ 20 من المضادات الحيوية الشائعة تجاه عزلات البكتريا وباستخدام جهازال VITEK2 ايضا.

من بين 200 عينة تم جمعها من عدوى الجروح ، تم تحديد 43 عزلة من أنواع Pseudomonas بمعدل 21.5٪ وكانت عزلات *Pseudomonas aeruginosa* الأكثر شيوعًا من بين الأنواع الأخرى من عائلة ال Pseudomonas ، حيث اشتملت على 33 عزلة (77٪) من *Pseudomonas aeruginosa* ، ثم تبعته 7 عزلات من *P. putida* (16٪) ، و 3 عزلات من *P. fluorescens* (7%) وقد تم عزل 29 عزلة من الذكور وبنسبة (67٪) ، بينما تم عزل البقية 14 من الإناث وبنسبة (33٪).

أظهرت نتائج أنماط الحساسية أن المضادين Amikacin و Piperacillin-Tazobactam كانا أكثر المضادات الحيوية فاعلية ضد Pseudomonas aeruginosa ، يليه Piperacillin ، ثم Colistin مع Tobramycin. كما أظهر كل من المضاد الحيوي Meropenem و imipenem مستوى عاليً من النشاط ضد عزلات *P. putida* و *P. fluorescens* ، بينما كانت حساسيتهما متوسطة تجاه *Pseudomonas aeruginosa*. كما تم الكشف عن حساسية معتدلة من قبل Ciprofloxacin، Levofloxacin، Ceftazidime بينما جميع العزلات كانت مقاومة لمضادات Cefixim و Ceftriaxon و Cefazolin و Co-Trimethoprim و Amoxiclav و Amoxiclav وحساسية منخفضة لـ Cefepime.

الكلمات المفتاحية: Pseudomonas ، التهابات الجروح ، اختبار الحساسية للمضادات الحيوية