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Comparative study for antibiotic susceptibility against *Pseudomonas aeruginosa* isolated from otitis media through several years in Thi-Qar Province/Iraq

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Abstract

Otitis media is a common worldwide health care problem infects peoples at different ages, *Pseudomonas aeruginosa* is the most frequent causative agent responsible for the disease with high ability to resists antibiotics. The study aimed to compare the developments of antibiotic resistance among *Pseudomonas. aeruginosa* through some years. The study including (77) specimens were positive for P. aeruginosa collected in Al-Habobi teaching hospital in Al-Nasiriyah city/South of Iraq through the periods from 2015 to 2020, antibiotic susceptibility test was done by disc diffusion technique. The results revealed no significances in the infections between two genders, But the isolates showed high significant differences (p value ≤ 0.001) according to years and the Amikacin is the most effective antibiotic against this bacteria (64.9%). In brief, The study showed no differences in antibiotic susceptibility of *P. aeruginosa* in the years of study with high resistance for several antibiotics and the Amikacin was most effective antibiotic against P. aeruginosa isolates causing otitis media

Keywords: Otitis media, *Pseudomonas aeruginosa*, antibiotic resistance.

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Introduction

Otitis Media affects the mucous coating that covers the cavity of middle ear. The disease initiates as a result of bacteria or viruses entering the upper pharynx through the Eustachian tube into the middle ear cavity (1). There is no consensus in the medical literature on the etiology of this inflammation,the debate is over whether it is a bacterium or a virus. The most common bacteria involved in this disease are: *Haemophilus influenzae, Streptococcus pneumoniae, Pseudomonas aeruginosa* and, to a lesser extent, *Escherichia coli*, *Staphylococcus aureus*, *Streptococcus pyogenes, Proteus mirabilis*, *Klebsiella spp,* or mixed bacterial infection, Group A streptococcus (Streptococcus Group A) and Gram-negative aerobic (*Branamella catarrallis*)[2-6]. The main complications that can occur due to otitis media are: permanent perforation of the eardrum, decreased hearing ability, mastoiditis and damage to the hearing bones and the seventh nerve that moves the facial muscles, inflammation of the brain membrane[4,5,6]

Pseudomonas aeruginosa (*P. aeruginosa*) is a part of normal intestinal flora as well as a considerable pathogen that is accountable for various ICU-acquired infections in patients who are critically ill. The nosocomial infections related to this organism involve meningitis, blood stream infections, urinary tract infections, respiratory tract infections, wound infections and otitis media [6]. Standard antibiotic regimes against the P. aeruginosa were more and more unsuccessful due to the increase in drug resistance. In addition, antibiotics resistance in the multiple strains related to P. aeruginosa was a clinical subject that is developing rapidly, while the definitions regarding multidrug resistance *P. aeruginosa* (MDRPA) was isolates resistant to minimum of 3 drugs from various antimicrobial categories, involving cephalosporinsand quinolones, aminoglycosides, carbapenems and anti-pseudomonas penicillin were categorized as multidrug resistant[7,8].Our study also aimed to determine the development of theP. aeruginosa antibiotic resistance during the course of ear infections.

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Methodology

Data collection

The specimens were collected from Al-Habobi teaching hospital in Al-Nassiriah city/South of Iraq through the periods from 2015 to 2020, the study involved (77)specimens that gave a positive culture results for *P. aeruginosa*.

Antibiotic susceptibility test

The test was performed by using disc diffusion test including: cefotaxime (CTX), cefetriaxone (CRO), Co-amoxyclav (AMC), Azithromycin (AZM), Doxycycline (DXT), Amikacin (AK) and Gentamicin (CN) which supplied from (bioanalyse-Turkey).

Statistics

The statistics was done by using Chi square and ANOVA by Statistical Package for the Social Sciences (SPSS) program (version 22). All of statistical tests were two-sided and a level of $P<0.05$ used to detects significance differences.

Results :

The results shown no significant differences in distribution of patients according to gender under $p\leq 0.05$ as revealed in table (1).

Table 1:Distribution of the gender according to years of study

			Gender		Total
			Male	Female	
Year of	15th	Count	4	6	10
		% within year	40.0%	60.0%	100.0%
		% within gender	10.5%	15.4%	13.0%

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	16th	Count	9	9	18
		% within year	50.0%	50.0%	100.0%
		% within gender	23.7%	23.1%	23.4%
	17th	Count	5	8	13
		% within year	38.5%	61.5%	100.0%
		% within gender	13.2%	20.5%	16.9%
	18th	Count	3	7	10
		% within year	30.0%	70.0%	100.0%
		% within gender	7.9%	17.9%	13.0%
	19th	Count	7	7	14
		% within year	50.0%	50.0%	100.0%
		% within gender	18.4%	17.9%	18.2%
	20th	Count	10	2	12
		% within year	83.3%	16.7%	100.0%
		% within gender	26.3%	5.1%	15.6%
Total		Count	38	39	77
		% within year	49.4%	50.6%	100.0%
		% within gender	100.0%	100.0%	100.0%

Chi-square = 8.014, p= 0.056

Antibiotic susceptibility of *P. aeruginosa* isolates according to years showed high significant differences (p value ≤ 0.001), where Amikacin is the most effective antibiotic against this bacteria (64.9%) of isolates were sensitive to this antibiotic as illustrated in table (2).

Table (2): Antibiotic susceptibility pattern of *P. aeruginosa* isolates according to years

Antibiotic		Years of comparison						Total	FE, p value
	Status	15.00	16.00	17.00	18.00	19.00	20.00		

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CTX 5 µg	Sensitive	1	4	1	1	1	1	9	29.905 0.001
		10.0%	22.2%	7.7%	10.0%	7.1%	8.3%	11.7%	
	Resistant	8	12	4	1	4	10	39	
		80.0%	66.7%	30.8%	10.0%	28.6%	83.3%	50.6%	
	Intermediate	1	2	8	8	9	1	29	
		10.0%	11.1%	61.5%	80.0%	64.3%	8.3%	37.7%	
CRO 5 µg	Sensitive	2	5	1	2	3	1	14	29.096 0.001
		20.0%	27.8%	7.7%	20.0%	21.4%	8.3%	18.2%	
	Resistant	6	12	4	1	3	10	36	
		60.0%	66.7%	30.8%	10.0%	21.4%	83.3%	46.8%	
	Intermediate	2	1	8	7	8	1	27	
		20.0%	5.6%	61.5%	70.0%	57.1%	8.3%	35.1%	
AMC 10 µg	Sensitive	0	2	1	1	0	1	5	25.937 0.001
		0.0%	11.1%	7.7%	10.0%	0.0%	8.3%	6.6%	
	Resistant	10	10	4	1	5	9	39	
		100.0%	55.6%	30.8%	10.0%	38.5%	75.0%	51.3%	
	Intermediate	0	6	8	8	8	2	32	
		0.0%	33.3%	61.5%	80.0%	61.5%	16.7%	42.1%	
AZM 30 µg	Sensitive	1	4	1	0	5	3	14	23.315 .005[b]
		10.0%	22.2%	7.7%	0.0%	35.7%	25.0%	18.2%	
	Resistant	4	7	11	8	5	1	36	

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		40.0 %	38.9 %	84.6 %	80.0 %	35.7 %	8.3%	46.8 %	
	Intermediate	5	7	1	2	4	8	27	
		50.0 %	38.9 %	7.7%	20.0 %	28.6 %	66.7 %	35.1 %	
DXT 30 µg	Sensitive	3	2	0	1	0	1	7	17.546.027[b]
		30.0 %	11.1 %	0.0%	10.0 %	0.0%	9.1%	9.2%	
	Resistant	3	7	9	8	8	2	37	
		30.0 %	38.9 %	69.2 %	80.0 %	57.1 %	18.2 %	48.7 %	
	Intermediate	4	9	4	1	6	8	32	
		40.0 %	50.0 %	30.8 %	10.0 %	42.9 %	72.7 %	42.1 %	
AK 5 µg	Sensitive	8	16	9	0	10	7	50	38.529.000[b]
		80.0 %	88.9 %	69.2 %	0.0%	71.4 %	58.3 %	64.9 %	
	Resistant	0	0	4	10	2	3	19	
		0.0%	0.0%	30.8 %	100.0 %	14.3 %	25.0 %	24.7 %	
	Intermediate	2	2	0	0	2	2	8	
		20.0 %	11.1 %	0.0%	0.0%	14.3 %	16.7 %	10.4 %	
CN 5 µg	Sensitive	4	8	7	8	4	5	36	11.153.334[b]
		40.0 %	44.4 %	53.8 %	80.0 %	28.6 %	41.7 %	46.8 %	
	Resistant	1	4	3	1	7	4	20	
		10.0 %	22.2 %	23.1 %	10.0 %	50.0 %	33.3 %	26.0 %	
	Intermediate	5	6	3	1	3	3	21	
		50.0	33.3	23.1	10.0	21.4	25.0	27.3	

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		%	%	%	%	%	%	%	
	Total	10	18	13	10	14	12	77	
		13.0 %	23.4 %	16.9 %	13.0 %	18.2 %	15.6 %	100.0 %	

P. aeruginosa outcome according to the number of antibiotics susceptibility was shown in table (3) where its reveals high levels of antibiotics resistance.

Table 3: Culture outcome according to the number of antibiotic belonging to outcome category

		Sensitive		Intermediate		Resistant	
		Freq.	%	Freq.	%	Freq.	%
Number of ABC	No one	3	3.9	12	15.6	31	40.3
	Only one	3	3.9	15	19.5	2	2.6
	Two	19	24.7	17	22.1	2	2.6
	Three	17	22.1	4	5.2	3	3.9
	Four	14	18.2	2	2.6	1	1.3
	Five	11	14.3	4	5.2	14	18.2
	Six	6	7.8	6	7.8	6	7.8
	Seven	3	3.9	13	16.9	6	7.8
	Eight	1	1.3	2	2.6	6	7.8
	Ten			2	2.6	5	6.5
	Eleven					1	1.3
Total	77						100

Discussion

Ear infections is the one of the most common illness that worldwide distributed infects persons at different ages specially children. *P. aeruginosa* is a most frequent isolated pathogen of ear infections that is recorded by many researches [9,10,11] if they're not treated may become worse and causes deafness, and can lead to severe infections in immune-compromised patients and if not treated properly it may converts to life threating [12,13].

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Our current study was designed to compare the development of resistance to antibiotics in bacterial isolates over several years. There were no significant differences in the development of resistance during the study years. This may be due to the presence of specific stability in local isolates and to the use of effective antibiotics in the treatment of infection cases despite the presence of a number of multi-resistant isolates.However, the study showed high resistance patterns of *P. aeruginosa* isolates which consistence with the previous studies [5,14,15]. But, a significant number of isolates were sensitive to Amikacin, followed by gentamicin. However, they were exhibited high resistance to other antibiotics under the study which is compatible to several studies [16,17]. The high resistance of this bacteria occur due to multidrug efflux pumps and the low permeability of bacterial cell membrane and the production of several antibiotic degrading enzymes such as: metallo-β-lactamase enzymes [6,18,19].

Conclusion

The study showed no differences in antibiotic susceptibility of P. aeruginosa in the years of study with high resistance for several antibiotics and the Amikacin was most effective antibiotic against P. aeruginosa isolates causing otitis media.

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دراسة مقارنة لفاعلية المضادات الحياتية ضد بكتريا الزائفة الزنجارية المعزولة من التهاب الأذن الوسطى خلال عدة سنوات

الملخص

التهاب الأذن الوسطى هو مشكلة صحية شائعة في جميع أنحاء العالم تصيب الأشخاص في مختلف الأعمار ، الزائفة الزنجارية هو العامل المسبب الأكثر شيوعًا المسؤول عن المرض مع قدرة عالية على مقاومة المضادات الحياتية. هدفت الدراسة إلى مقارنة تطورات مقاومة المضادات الحياتية بين الزائفة الزنجارية خلال بعض السنوات. الدراسة التي اشتملت على (77) عينة كانت ايجابية لبكترياالزائفة الزنجارية تم جمعها في مستشفى الحبوبي التعليمي بمدينة الناصرية / جنوب العراق خلال الفترات من 2015 إلى 2020 ، وتم اختبار الحساسية للمضادات الحياتية بتقنية الانتشار القرصي. لم تظهر النتائج أي دلالة في العدوى بين الجنسين ، لكن العزلات أظهرت فروق معنوية عالية ($p \leq 0.001$) حسب السنوات وكان Amikacin هو المضاد الحياتي الأكثر فاعلية ضد هذه البكتيريا (64.9٪). باختصار ، أظهرت الدراسة عدم وجود فروق في الحساسية للمضادات الحياتية من الزائفة الزنجارية في سنوات الدراسة مع مقاومة عالية للعديد من المضادات الحياتية وكان Amikacin هو المضاد الحياتي الأكثر فعالية ضد عزلات الزائفة الزنجارية المسببة لالتهاب الأذن الوسطى.

الكلمات الدالة: التهاب الاذن. الزائفة الزنجارية, مقاومة المضادات الحياتية