

RESEARCH ARTICLE

Detection of the Antibiotic Susceptibility Against *Proteus* Species and *Escherichia coli* Isolated from Patients with Ear Infections

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ABSTRACT

Introduction: Infections of the ear affect all ages especially infants and young and can be divided into two main forms such as otitis media and otitis externa. Ear infections associate with several types of pathogenic microorganism, replicate of antibiotic uses, age and health care. The most prevalence pathogenic bacteria of ear infections are *Proteus* spp and *Escherichia coli*. The resistance of the antibiotic represents a biggest problem to the human health.

Methods: The samples of ear swabs are collected with sterile wooden sticks and the sterile container. This for isolation and detection of the *E. coli*, *Proteus* spp and *Acinetobacter* spp through using the biochemical tests and the VITEK 2 system. And then determine the antibiotic activity patterns against these bacteria through use the disc diffusion method on the plates of Moller Hinton agar by many antibiotic types.

Results: Among all ear swab samples the percentage of positive bacterial growth is 33.333 %, and the percentage of both *Proteus* spp and *E. coli* equal to 20%. The females are more infective with infect percent equal to 60% than males, which equal to 40%. The Antibiotic susceptibility patterns show Azithromycin, Gentamycin, Amikacin, Imepinam and Meropenime have activity against *Proteus* spp. Whereas Cefoxitin, Ciprofloxacin, Levofloxacin, Ceftriaxone, Meropenime, Amkacin and Gentamycin have activity against *E. coli*. And Pipicarcillin/Tazobactam, Cefazalin, Cefepime and Imepinam have activity against *Acinetobacter* spp.

Keywords: *Acinetobacter* spp, Antibiotics, Ear infection, *Escherichia coli*, *Proteus* spp.

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INTRODUCTION

Infection of the ear has two main forms which include, otitis media and otitis externa, this caused by different types of pathogenic gram-negative bacteria, especially the *Escherichia coli* and *Proteus* spp, and this infection represents one of the most common illnesses in the children. The infection of the ear represents the universal clinical problem and the most reason of sensory hearing loss in the developing countries.¹⁻² This infection effect both the children and adults in the worldwide.³ But more common in the children.⁴ And cause delays in the development of the language and speech.⁵ As well as the education and academy.⁶ Another ear infection risk factors which include, age of younger maternal,⁷ male sex, age younger, and status of low socioeconomic,⁸⁻⁹ low weight of birth,⁹ conditions of inadequate housing and lack of access health care,¹⁰ exposure to smoking of cigarette,⁸⁻⁹ and Mothers which smoke through pregnancy.⁷ The ear infection can cause both the otitis media and otitis externa, also this infection can be temporary acute or persistent chronic.¹¹ In general, infection of the ear is mild and

themselves resolve through short period, and if remain without treatment, may lead to loss of the hearing in the future.¹² The most common pathogenic gram negative bacteria of the ear infections, which is *Proteus* spp and *Escherichia coli*, as demonstrated this by wide studies through over the years.¹³ The prevalence bacterial isolates which are causes of ear infection are *E. coli* and *P. mirabilis*.^{14,15} Increase the resistance of the wide spectrum antibiotics because of the irrational use against bacterial isolates represent the biggest threat to global health.^{16,17} The raised of the antibiotic resistance among the ear infections bacteria can lead to the development of complications of the other diseases.¹⁴ It should be noted that the indiscriminate and increased use of antibiotics can cause an increase in antibiotic resistance, resulting in significant economic losses.

MATERIAL AND METHODS

The Samples

The ear swab samples have been collected by sterile wooden sticks, then placed in the sterile container, and transferred

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to the Imam Ali hospital lab at the Babylon Province. These samples were used for identification of *E. coli*, *Proteus* spp and *Acinetobacter* spp and detection the antibiotic activity patterns against these bacteria.

Identification of the *E. coli*, *Proteus* spp and *Acinetobacter* spp Bacteria

The pathogenic bacteria of *E. coli*, *Proteus* spp and *Acinetobacter* spp have been identified using the biochemical test and VITEK 2 system, and as shown in the Table 1.

Identification of the Antibiotics Susceptibility

Determine the susceptibility of antibiotics against *Proteus* spp, *E. coli* and *Acinetobacter* spp, which isolated from samples of ear swabs through use the disc diffusion method on the plates of Moller Hinton agar by many antibiotic types. This method was conducted by incubation of *Proteus* spp, *E. coli* and *Acinetobacter* spp with the antibiotics on Moller Hinton agar plates for 24 hours, then measure the formed inhibition zones in bacterial cultures through using the special millimetre ruler.

RESULTS

The ear swab samples have been collected for isolation and identification of *Proteus* spp, *E. coli* and *Acinetobacter* spp, and determine the antibiotic susceptibility against these bacteria. Figure 1 shows the growth percent was 33.333% of all samples of the ear swabs. Figure 2 explains the ages (1–9 year) were more bacterial identification by percent equal to 60%. Figure 3 shows the females were more infective with infect percent equal to 60% than males which were equal to 40%. Table 2 explains the *Proteus* spp and *E. coli* which were more identified bacteria, both with percent equal to 20%. Table 3 shows Azithromycin, Gentamycin, Amikacin, Imepinem and Meropenime have activity against *Proteus* spp. Whereas Cefoxitin, Ciprofloxacin, Levofloxacin, Ceftriaxone, Meropenime, Amkacin and Gentamycin have activity against *E. coli*. And Pipicarcillin/Tazobactam, Cefazalin, Cefepime and Imepinem have activity against *Acinetobacter* spp.

DISCUSSION

The current study explains the age category (1–9 year) was more infective with an ear infection equal to 60%. In study of Karunanayake *et al.*, who determine the age category (6–11 year) was more risk with ear infection equal to 58.1%.¹⁸

While the Addas *et al.*, who demonstrated the majority of patients were in the age group (0–17 years) equal to 38.1%.¹⁹ It has been recorded that 69% of United State children under 12 years of the age, having at least one ear infection in the lifetime.²⁰ In this study the females were more susceptible to ear infection in comparison to males with infect percent equal to 60% and 40%, respectively. According to Addas *et al.*, who found the majority of the ear patients were females with infect percent equal to 65.8% in comparison to males which were equal to 34.2%.¹⁹ Whereas the Hailu *et al.*, who identified this infection was lower in females than males with

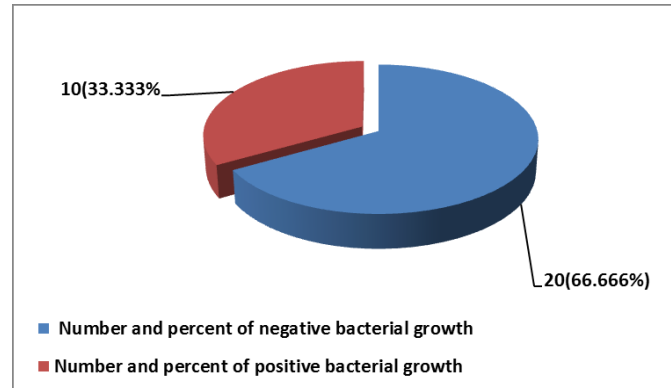


Figure 1: Comparison between the samples with bacterial growth and non-bacterial growth.

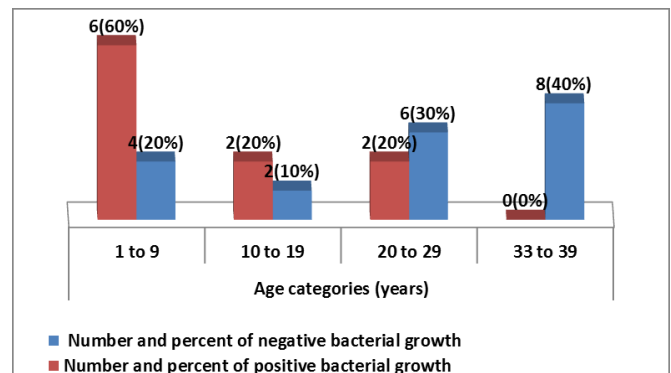


Figure 2: Distribution of gram-negative bacteria according to the age categories.

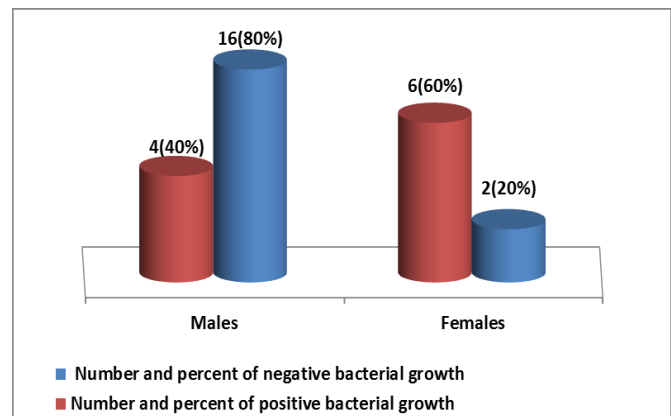


Figure 3: Distribution of gram-negative bacteria according to the gender.

Table 1: Identification of Gram-negative Bacteria.

No.	Pathogenic bacteria	Procedure
1.	<i>Proteus</i> spp	VITEK 2 System
2.	<i>E. coli</i>	&
3.	<i>Acinetobacter</i> spp	Biochemical tests

Table 2: Comparison between the presence of pathogenic gram negative bacterial species.

No.	Bacterial species	Positive percentage (%)
1.	<i>Proteus</i> spp	20
3.	<i>E. coli</i>	20
4.	<i>Acinetobacter</i> spp	10

Table 3: Antibiotic susceptibility against pathogenic gram-negative bacteria.

No.	Pathogenic bacterial	Antibiotic sensitive	Antibiotic resistant
1.	<i>Proteus</i> spp	Azithromycin	Amikacin
		Gentamycin	Nalidixic acid
2.	<i>E. coli</i>	Amikacin	Erythromycin
		Imipenem	Trimethoprim
		Meropenem	Ciprofloxacin
			Ceftriaxone
			Amoxiclavate
		Cefoxitin	
		Ciprofloxacin	Trimethoprim
		Levofloxacin	Cefepime
		Ceftriaxone	Ceftriaxone
		Meropenime	Amoxiclavate
3.	<i>Acinitobacter</i> spp	Amkacin	
		Gentamycin	
		Pipicarcillin/Tazobactam	
		Cefazalin	Gentamycin
		Cefepime	Trimethoprim/Sulfonamide
		Imepinem	

65% and 92.7%, respectively.²¹ The positive growth percent of the ear swab in the present study was 33.333%. Anie *et al*, who found the positive growth percent of gram-negative bacteria was 23.9%;²² While Hailu *et al*, who identified the positive growth percent of this bacteria was 58.8% in the ear infection.²¹ Muluye *et al.*, who found the positive growth of gram negative bacteria was 56.4% and the predominant bacteria was *proteus* species by growth percent equal to 27.5%.²³ In this study, the growth percent of *Proteus* spp, *E. coli* and *Acinitobacter* spp of the ear swab isolates were equal to 20%, 20% and 10%, respectively. In study of Estifanos *et al*, who found the growth percent of *Proteus* spp, *E. coli* and *Acinitobacter* spp in the ear infection was 30 %, 3.33 % and 3.33 %, respectively.²⁴ Also in study of Addas *et al*, who identified the growth percent of *Proteus* spp, *E. coli* and *Acinitobacter* spp was 8.2%, 4.1% and 0.7%, respectively.¹⁹ While in study of Tadesse *et al*, who identified the growth percent of *Proteus* spp, *E. coli* and *Acinitobacter* spp was 12.5%, 7.2% and 1.3%, respectively.²⁵ In study of Argaw-Denboba *et al*, who demonstrated the growth percent of *Proteus* spp and *E. coli* was 28.8% and 16.4%, respectively.²⁶ And in study of Hailu *et al*, who found the growth percent of *Proteus* spp and *E. coli* in this infection was 22.3% and 2.4%, respectively.²¹ The variations appearing among percent of males and females, also differences in the growth percentages of pathogenic gram-negative bacteria in this study are unclear, but may due to the differences in behaviors, study areas and care-seeking.²⁷ In the present study, the antibiotics Azithromycin, Gentamycin, Amikacin, Imepinem and Meropenime have activity against *Proteus* spp. While the antibiotics Cefoxitin, Ciprofloxacin, Levofloxacin, Ceftriaxone, Meropenime, Amkacin and Gentamycin have activity against *E. coli*. And the antibiotics Pipicarcillin/ Tazobactam, Cefazalin, Cefepime and Imepinem have activity against *Acinitobacter* spp. In a study of Tadesse *et al*, who identified the antibiotic percentage of resistance patterns against *Proteus* spp, by Ciprofloxacin, Gentamycin,

Amoxicillin Clavulanic acid, Ceftraxone and Meropenem was (0.0), (10.5), (57.9), (10.5) and (21.1) respectively; while against *E. coli* by Ciprofloxacin, Gentamycin, Amoxicillin Clavulanic acid, Ceftraxone and Meropenem was (36.4), (18.2), (81.8), (18.2) and (0.0) respectively; and against *Acinitobacter* spp by Gentamycin and Trimethoprim-sulphamethoxazole was (0.0) and (100) respectively.²⁵ While a study of Hamze *et al*, who demonstrated the percent of antibiotic susceptibility against *Proteus* spp, by amoxicillin/clavulanate, Azithromycin, Imepinem, Meropenem, Ceftriaxone, Gentamycin, Amikacin and Ciprofloxacin was (89.5), (89.5), (78.9), (100), (89.5), (78.9), (100) and (78.6) respectively; whereas against *E. coli* by Cefoxitin, Meropenem, Ceftriaxone, Gentamycin, Amikacin and Ciprofloxacin was (83.3), (100), (79.2), (66.7), (95.8) and (70.8) respectively; and against *Acinitobacter baumannii* by Piperacillin/tazobactam, Cefepime, Imipenem and Gentamicin was (100), (100), (100) and (80) respectively.²⁸ In a study of Muluye *et al*, who found the percent of antibiotic resistance against *Proteus* spp, by Ceftriaxone, Ciprofloxacin, Erythromycin and Gentamycin (30.4), (17.9), (23.2) and (21.4) respectively; and against *E. coli*, by Ceftriaxone, Ciprofloxacin, Erythromycin and Gentamycin was (50), (14.3), (42.9) and (14.3) respectively.²³ In a study of Gorems *et al*, who explained the percent of antibiotic resistance against *P. mirabilis*, by Amoxiclavate, Ceftriaxone, Ciprofloxacin, Gentamicin and Amikacin (50), (50), (10), (30) and (30) respectively; and against *E. coli*, by Amoxiclavate, Ceftriaxone, Ciprofloxacin, Cefepime, Gentamicin and Amikacin (33.3), (33.3), (11.1), (22.2), (33.3) and (11.1) respectively.²⁹ The variations in antibiotic susceptibility pattern might due to the frequent and different use of these antimicrobials in treating the infections of the ear in different geographical areas, also increase the antibiotic resistance the different bacterial types may due to their misuse, stores, purchase without physician prescription and through habits and inappropriate describe of these antibiotics for treatment every infection.

CONCLUSIONS

Ear infections, can affect all ages, especially infants and young, the most prevalence bacteria of this infection were *Proteus* spp and *E. coli*. The females were more infective than males. The Antibiotic susceptibility patterns showed Azithromycin, Gentamycin, Amikacin, Imepinem and Meropenime have activity against *Proteus* spp. Whereas Cefoxitin, Ciprofloxacin, Levofloxacin, Ceftriaxone, Meropenime, Amkacin and Gentamycin have activity against *E. coli*. And Pipicarcillin/ Tazobactam, Cefazalin, Cefepime and Imepinem have activity against *Acinitobacter* spp.

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