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Study The Sensitivity of Bacteria Isolated From Sputum of Different Antibiotics Using Kirby-Bauer Method

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ABSTRACT

Background: Respiratory tract infections caused by bacterial infections are among the most common health problems, exacerbated by antibiotic resistance. **The aim** of the study is to isolate and identify pathogenesis bacteria that responsible to respiratory system diseases from 35 samples of sputum and determine bacterial sensitivity to various antibiotics. **materials and Method:** A cross-sectional study was conducted in Almuthanna Governorate-Iraq on 35 patients (26:35 male and 9:35 female) age ranged from 15 - 50 years old, the bacteria were diagnosed by physical examination, bacterial dyes and AIP examination in order to reach a final result for the diagnosed bacterial race. Antibiotics sensitivity testing was performed to determine the bacterial sensitivity using 30 different antibiotics by Kirby-Bauer disk diffusion method. **Result:** The study showed that there are four different species of bacteria, *Streptococcus pneumonia* (3:35), *Mycoplasma Pneumoniae* (8:35), *Escherichia colli* (1:35), *staphylococcus aureus* (23:35). As for examining of bacterial sensitivity of the isolated bacteria used in this study, showed different sensitivity to each antibiotic, *Strept. pneumonia* showed sensitivity to (16:30) of antibiotics and the beast effect of antibiotics is Amikacin it was 100%. *M. Pneumoniae* showed sensitivity to (7:30) of antibiotics and the beast effect of antibiotics is Doxycycline it was 100%. *E. colli* showed sensitivity to (3:30) of antibiotics and the beast effect of antibiotics are Amikacin, Imipenem and Meropenem it was 100%. *S. aureus* showed sensitivity to (19:30) of antibiotics and the beast effect of antibiotics is Nitrofurantionit was 100%. The results of this study can be used by assist clinicians to determine the sensitivity of bacteria to antibiotics and prescribe the appropriate antibiotic for treatment of respiratory tract infections caused by bacterial infections.

Keywords: Respiratory tract infections, Bacterial infections, Bacterial sensitivity, Antibiotics resistance, Kirby-Bauer.

1. Introduction

Respiratory infections caused by bacteria are among the most common illnesses in the world, mortality rate between 5% - 10% according to the Centers for Disease Control (CDC) [1]. Currently, laboratory diagnostic techniques through culture are an important necessity for accurately diagnosing bacterial infections and prescribing appropriate treatments [2]. Bacterial causes of respiratory tract infections are among the most common diseases due to their widespread prevalence in the world among all races and ages [3], which can range from mild to severe infections and can lead in some cases to death [4], and it is the fourth leading cause of death in the world [5].

Therefore, it is important to study the factors causing respiratory tract infections and study its resistance and sensitivity to antibiotics and prescribe the appropriate antibiotic for them [6]. Although some bacterial infections of the respiratory system can be treated with antibiotics, in many cases the

bacteria causing RTIs appear to be resistant to many types of antibiotics [7]. Therefore, it is necessary to conduct culture tests for bacteria isolated from the respiratory system and test the antibiotics available on them [8]. Thus, the appropriate type of antibiotic can be determined to treat the bacterial type diagnosed and isolated from patients with RTIs. Because it reduces the patient's hospital stay, in addition to controlling bacterial resistance to antibiotics by prescribing the appropriate antibiotic for the bacteria, thus preventing the emergence of new antibiotic-resistant strains due to the excessive and indiscriminate use of antibiotics [9].

2. Search strategy:

A cross-sectional study was conducted in Al-Muthanna Governorate-Iraq on 35 patients (26:35 male and 9:35 female) ages ranged between 15 - 50 years suffering from respiratory tract. Samples were collected between July and August 2025. The study focused on identifying the bacterial species that cause respiratory tract infections by isolating and diagnosing them and conducting an antibiotic sensitivity test to determine their sensitivity using the disc diffusion Kirby-Bauer method, thus, determining the appropriate antibiotic to treat cases according to the causative bacterial species.

2.1. Sample collection methods

Samples were collected by giving the patient a sterile 30 ml container to cough deeply into in order to collect sputum samples, while ensuring that the patient had not taken antibiotics for a period of no less than 3 days from the date of the examination, in addition to ensuring that he had not used any type of oral antiseptic for a period of no less than 18 hours from the date of taking the sample, or consumed foods or drinks containing dyes or any type of coffee. The sample is then directly cultured on culture media [10].

2.2. In vitro cultivation

Sputum samples were cultured in the laboratory on three different culture media: blood agar, chocolate agar, and MacConkey agar using a sterile loop, the sputum sample was transferred to the culture medium for culture by streak plate method and it was incubated in an incubator at a temperature of 37C for 24 hours. This process in order to prepare it for the bacterial diagnostic and identification and to prepare for the process of transferring the pure bacterial colony to Mueller-Hinton agar in order to conduct an antibiotic sensitivity test [11].

2.3. Bacterial diagnosis

After the appearance of bacterial growth in the form of colonies on the used culture media, the bacteria were diagnosed by physical examination in terms of the type of hemolysis, color, shape and dimensions of the colonies. In addition, bacterial dyes were used in addition to the AIP examination in order to reach a final result for the diagnosed bacterial race.

2.4. Antibiotic sensitivity test

The identified bacterial colonies were transferred to Miller-Hinton medium for culture and preparation for testing their sensitivity to 30 different antibiotics, the process was performed using technology of disc diffusion Kirby-Bauer method, 6 antibiotic discs were used for each plate, and 6 plates were used for each isolated bacterial species to test 30 antibiotic discs, then it was incubated at 37°C for 24 hours to be ready for reading the results [12].

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3. Results

The study which was conducted on 35 patients suffering from symptoms of respiratory infections, showed that there are four different species of bacteria, Streptococcus pneumonia (3:35), Mycoplasma Pneumoniae (8:35), Escherichia colli (1:35), staphylococcus aureus (23:35) as shown in (Table 1).

Table 1. Identified bacterial species.

S	Bacterial species	n:N	%
1.	Streptococcus pneumoniae	**3:*35***	***8*.57**
2.	Mycoplasma Pneumoniae	**8:*35***	**22.85**
3.	Escherichia colli	***1*:*35***	**2.85**
4.	staphylococcus aureus	***23*:*35***	**65.71**

n:N: Number of bacteria out of the total number of bacteria.

%: Percentage of bacterial.

As for bacterial infections with gender Strept. pneumonia showed two infections in male and one infection in female, while M. Pneumoniae showed six infections in male and two infections in female, as for E. colli showed only one infection in male and no infection was recorded in female. As for s. aureus, it showed 17 infections in male and six infections in female (Figure 1).

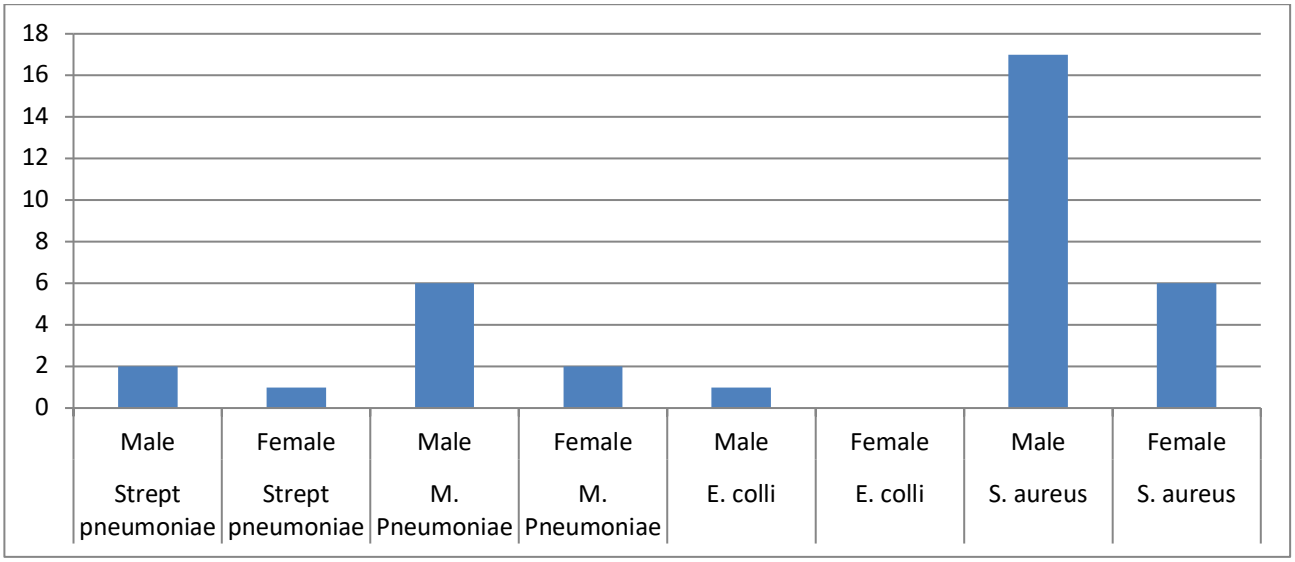

Figure 1. Classification of bacterial infections by gender.

The study conducted on the identified bacterial species showed that there is a difference in their resistance and sensitivity to the various antibiotics to which they were exposed, as shown in (Table 2).

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Table 2. Results of bacterial sensitivity to antibiotics

Antibiotics	Strept pneumoniae		M. Pneumoniae		E. colli		S. aureus	
	sensitivity	%	sensitivity	%	sensitivity	%	sensitivity	%
Amoxicillin	-	0	S	12.5	-	0	-	0
Augmentin	-	0	-	0	-	0	-	0
Amikacin	S	100	-	0	S	100 %	S	56.25
Azithromycin	-	0	S	75	-	0	-	0
Aztreonam	-	0	-	0	-	0	-	0
Cefixim	-	0	-	0	-	0	-	0
Cefepime	-	0	-	0	-	0	S	25
Cefotaxime	S	33.33	-	0	-	0	S	50
Ceftriaxone	S	66.66	-	0	-	0	S	43.75
Cef tazidime	-	0	-	0	-	0	S	31.25
Ciproflaxcine	S	66.66	-	0	-	0	S	43.75
Clarithromycin	-	0	S	62.5	-	0	-	0
Chloramphenicol	S	33.33	-	0	-	0	-	0
Doxycycline	S	66.66	S	100	-	0	S	56.25
Erythromycin	-	0	S	62.5	-	0	-	0
Imipenem	S	66.66	-	0	S	100 %	S	62.5
Meropenem	S	66.66	-	0	S	100 %	S	62.5
vancomycin	S	66.66	-	0	-	0	S	37.5
Norfloxacin	S	66.66	-	0	-	0	S	31.25
Nalidixicacid	S	33.33	-	0	-	0	-	0
Nitrofurantion	-	0	-	0	-	0	S	100
Neomycin	-	0	-	0	-	0	-	0
Piperacillin	-	0	-	0	-	0	-	0
Rifampicin	S	66.66	-	0	-	0	S	50
Levofloxacin	S	100	S	12.5	-	0	S	37.5
Trimethprim	S	66.66	-	0	-	0	S	37.5

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Tobramycin	-	0	-	0	-	0	S	37.5
Tetracycline	S	33.33	S	50	-	0	S	37.5
Gentamycin	S	33.33	-	0	-	0	S	43.75
Clindamycin	-	0	-	0	-	0	S	31.25

S: sensitive bacteria to antibiotic.

%: Percentage of total bacterial sensitivity to antibiotic.

4. Discussion

Culture is an effective method for identifying bacterial causes of bacterial respiratory infections, leading to rapid and effective prescription of the appropriate antibiotic and preventing long-term problems [13].

The study included 35 patients suffering from symptoms of respiratory infections, including: 26 males and 9 females, age ranged from 15 - 50 years old.

When samples taken from the patients' sputum were examined, four different types of bacteria were confirmed, as follows: Streptococcus pneumonia (3:35) 8.57%, Mycoplasma Pneumoniae (8:35) 22.85%, Escherichia colli (1:35) 2.85, staphylococcus aureus it is the most common bacterial type in the examined samples (23:35) 65.71% (Table 1).

As for bacterial infections with gender Strept. pneumonia showed (2) infections in male and (1) infection in female, while M. Pneumoniae showed (6) infections in male and (2) infections in female, as for E. colli showed only (1) infection in male and no infection was recorded in female, as for s. aureus, it showed (17) infections in male and (6) infections in female (Figure 1). It was concluded that men are more susceptible to respiratory infections. As for age, infections were distributed across all ages studied in this study, from 15 to 50 years old.

As for examining the sensitivity of the isolated bacteria to the antibiotics used in this study, Strept. pneumonia showed sensitivity to (16:30) of antibiotics and the beast effect of antibiotics is Amikacin it was 100%. M. Pneumoniae showed sensitivity to (7:30) of antibiotics and the beast effect of antibiotics is Doxycycline it was 100%. E. colli showed sensitivity to (3:30) of antibiotics and the beast effect of antibiotics are Amikacin, Imipenem and Meropenem it was 100%. S. aureus showed sensitivity to (19:30) of antibiotics and the beast effect of antibiotics is Nitrofurantionit was 100% (Table 2).

5. Conclusion

Based on the results of the study, *S. aureus* is the most common respiratory infections in the study conducted, male are more susceptible to RIs, and the antibiotics Amikacin Imipenem, Meropenem and Nitrofurantion are the most effective on the studied isolates bacteria. The results of this study can be used by assist clinicians to determine the sensitivity of bacteria to antibiotics and prescribe the appropriate antibiotic for treatment of respiratory tract infections caused by bacterial infections.

Recommendations: Conducting a sensitivity test for bacteria to antibiotics before giving randomly antibiotics and adherence to the full dose of antibiotic prescribed to the patient to reduces bacterial resistance to antibiotics.

Declaration of interests: There is no conflict of interest and nothing to declare.

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