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Effect of Antibiotics on Pathogenic Bacteria in Biological Specimens from Patients at Al Safwa Clinic in Tripoli

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Abstract:

This study investigates the effect of antibiotics on pathogenic bacteria isolated from biological specimens of patients at Al Safwa Clinic in Tripoli. Antibiotic resistance is a growing global health concern, driven by overuse and misuse of antibiotics. This study aims to evaluate the effectiveness of various antibiotics against bacterial isolates from patients at Al Safwa Clinic. **Methods:** Swabs were collected from patients' respiratory tracts, vaginas, wounds, urine, ears, and throats. Bacterial cultures were grown and identified through microbiological and biochemical tests. Antibiotic susceptibility was tested using the agar diffusion method with antibiotics including Ceftriaxone, Cefuroxime, Cefotaxime, Ceftazidime, Clarithromycin, Imipenem, Augmentin, Tobramycin, Gentamicin, Amikacin, and Chloramphenicol. **Results:** *Staphylococcus spp. (37%) was the most commonly isolated bacteria, followed by Streptococcus spp. (36%), Pseudomonas aeruginosa (23%), Proteus spp. (10%), Klebsiella pneumoniae (12%), and Escherichia coli (4%). Ceftriaxone, Imipenem, and Levofloxacin showed the highest inhibitory effects. Gentamicin and Amikacin were also effective, particularly against gram-positive bacteria. Augmentin, Cloxacillin, Ceftazidime, and Erythromycin exhibited low to no effectiveness.* **Conclusion:** The study highlights the prevalence of antibiotic-resistant bacteria in clinical settings and underscores the importance of ongoing surveillance and prudent antibiotic use to manage and mitigate resistance trends.

Key Words: Antibiotics, Bacteria Pathogenic, Antimicrobial

Introduction

Antibiotics are one of the most important medical developments of the twentieth century, revolutionizing the treatment and prevention of bacterial infections. They are essential in managing various infections and supporting medical procedures such as surgeries and organ transplants. However, rising antibiotic resistance due to overuse and misuse poses a serious global health threat. Resistant bacteria increase morbidity, mortality, and healthcare costs, leading to urgent calls for new antibiotics and better antibiotic stewardship. There are several recent studies, such as the Global Antimicrobial Resistance Study, a comprehensive study by Murray et al. (2022) Published in the Lancet analyzed data from 204 countries and estimated that 1.27 million deaths in 2019 were directly attributable to antimicrobial resistance (AMR), with the highest burden in sub-Saharan Africa and South Asia. The study of antibiotic resistance mechanisms was conducted by Holmes et al. (2021) in Nature Reviews Microbiology explored the genetic and biochemical mechanisms of antibiotic resistance, highlighting the role of horizontal gene transfer and mutations in the spread of resistance genes between bacterial populations. Hospital-acquired infections, on the other hand, were studied through research by Mauldin et al. (2022) in Clinical Infectious Diseases focusing on the spread of multidrug-resistant organisms (MDROs) in hospitals. They found that MDRO infections significantly increase hospital stays and healthcare costs. On the other hand, among antibiotic stewardship programmers, a systematic review conducted by Burr et al. (2020) Journal of Antimicrobial Chemotherapy evaluated the effectiveness of antibiotic stewardship programs (ASPs) in reducing antibiotic use and resistance. The study concluded that antimicrobials play a critical role in improving patient outcomes and reducing antimicrobial resistance. Alternatively, community-associated infections: It was in a study conducted by Tadesse et al. (2021) published in BMC Infectious Diseases investigated the prevalence of antibiotic-resistant bacteria in community settings. They found a rise in resistance cases in common pathogens, underscoring the need for public health interventions to address antimicrobial resistance beyond hospital settings.

Objective:

This study aims to evaluate the effect of antibiotics on pathogenic bacteria present in samples of patients at AL Safwa Clinic in Tripoli,

Materials and Methods

Limits of the Study

Spatial Boundaries: This study was conducted on biological laboratory samples from health facilities at AL Safwa Clinic in Tripoli.

Time Limits: This study was conducted in April 2019.

Study Population: Swabs were taken from patients attending AL Safwa Clinic in Tripoli.

Study Sample: In this study, we examined isolates to identify bacteria predominantly present in swab samples (respiratory tract, vagina, wounds, urine, ear, and throat) taken from patients attending AL Safwa Clinic in Tripoli.

Culture Media: A wide range of media were used for growing bacteria. Each organism was inoculated for 24-hour intervals onto broth, aerobically at 37°C. A loopful of this broth media was transferred to Potato Dextrose Agar (PDA, Oxoid England), which is suitable for growing a wide range of fungi.

Methods

Microbiological techniques:

Swab samples were taken from the vagina, urine, wounds, blood, ear, and throat Patients attending the outpatient clinic were patients attending the Al Safwa Clinic in Tripoli. Swabs were transferred to Muller-Hinton Broth, MH (CM 0405, Oxoid England). Then incubated at 37°C for 24-48 hours. After incubation, this broth liquid was transferred to the following Different culture media depending on the type of organism Muller-Hinton (MH) agar (CM 0337, Ox wood, England) and MacConkey agar, for E. coli. Various culture media were then incubated at 37°C for 24–48 dogs. All bacterial colonies were isolated. Bacteria were identified Either by microbiological examination or biochemical tests. Antibacterial Susceptibility tests were performed for all isolates of the identified bacterial species.

Antibiotic Study

The effects of Ceftriaxone, Cefuroxime, Cefotaxime, Ceftazidime, Clarithromycin, Imipenem, Augmentin, Tobramycin, Gentamicin, Amikacin, and Chloramphenicol were tested for microbial contamination of ear infections.

Determination of Antibiotic Activity:

The antibiotics' efficiency was evaluated using the agar diffusion method or disk diffusion method. Filter disks impregnated with antibiotics were applied to the surface of an agar plate containing the test organism and incubated at 37°C for 24-48 hours. The effectiveness of each antibiotic was indicated by the presence of growth-inhibition zones. The diameter of the inhibition zone was measured with a ruler.

Table: 1. The effect of different types of Antibiotic type of.

The effect of some of Antibiotic isolated from samples.	
Bacteriology lab	
Name:	
Specimen:	
Age\ Sex	
Destination	
Pathogen identified	
Sensitive.	
Intermediate Sensitive.	
Resistant.	
Note:	
Bacteriologist ----------------------------- Date -------------------------	

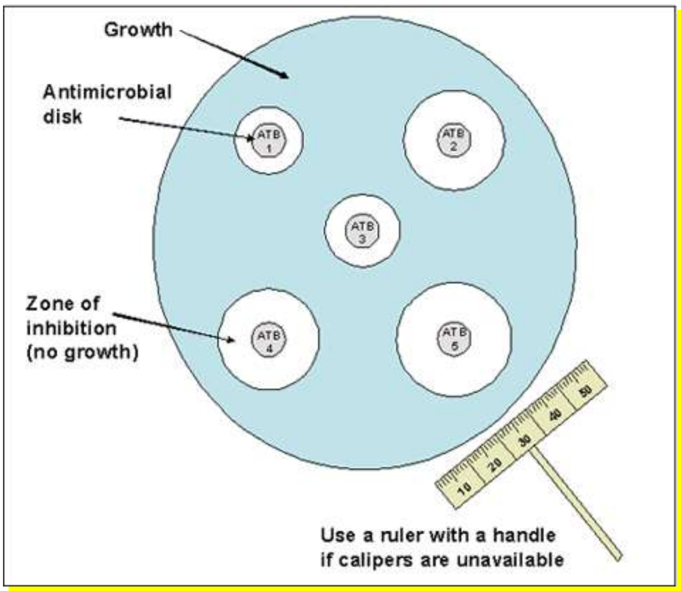

Figure 1: The antimicrobial susceptibility disk diffusion test: approximate disk placement and measurement of inhibition zone diameters. ATB1 = antibiotic 1, ATB2 = antibiotic 2, etc.

Results:

The study population included a total of 25 patients suffering from infections in the casualty department at AL Safwa Clinic in Tripoli, starting from 20 April 2019. Swabs were collected from external wounds, respiratory tract, vagina, throat, blood, ear, and urine from all patients.

The results of this study showed that the isolates from the studied samples included species of microbial infection (bacteria). Our results indicate that *Staphylococcus spp.* accounted for 37%, making it the most commonly cultured microorganism isolated from wound infections in our study group. These results indicate that the total number of identified bacteria comprised four different types: 36% were *Streptococcus spp*. (*Staph*. aureus 31% and *Pseudomonas aeruginosa* 6%), 23% were *Pseudomonas aeruginosa*, 10% were *Proteus spp*., and 12% were *Klebsiella pneumoniae* and *Escherichia coli*.

Table 1. Percentage of Different Bacteria Isolated

Types of Bacteria	Percentage
Streptococcus spp	36%
Staphylococcus spp	20%
Klebaiclla pneumonia	28%
Escherichia coil	04%
Total	100%

The results given in Table 2, based on the determination of the zone of inhibition using the sensitivity test, showed that Ceftriaxone, Imipenem, and Levofloxacin had large zone inhibitory effects. Gentamycin and Norfloxacin had medium effectiveness against some species of microorganisms. Augmentin had a low effect on all microorganisms. On the other hand, our results indicated that Cloxacillin, Ceftazidime, and Erythromycin were considerably less effective and had no inhibitory effect on all microorganisms. Based on the determination of the zone of inhibition using the sensitivity test, revealed that Chloramphenicol was the most effective antibiotic against gram-positive bacteria, causing inhibition of the growth of all bacteria. The zone of inhibition ranged from 17 to 25 mm, being highly effective against *Streptococcus pneumoniae*, *Staphylococcus epidermidis*, and *Staphylococcus aureus*. The second most important antibiotics were Gentamycin and Amikacin, which also showed effective inhibition on the growth of all isolated bacteria. Their zones of inhibition ranged between 17 and 22 mm, being highly effective against *Streptococcus* and *Staphylococcus spp*.

Additionally, antibiotics such as Ciprofloxacin, Imipenem, and Ceftriaxone showed good activity against most gram-negative bacteria. They exhibited growth inhibitory activity against all bacteria except Pseudomonas spp. and *Klebsiella pneumoniae*. By contrast, Cefotaxime, Augmentin, and Gentamycin had low activity against gram-negative bacteria. Cefotaxime and Chloramphenicol were considerably less effective and did not affect all bacteria. Loh et al. (1998) reported that eardrops containing Gentamycin or Polymyxin appear to be most effective against the three most common bacteria (*Pseudomonas aeruginosa*, Staphylococcus epidermidis, and Staphylococcus aureus) locally. Ciprofloxacin/ofloxacin otic solution is a new topical formulation that has a wide spectrum of activity against most common ear pathogens (Simpson and Markham, 1999). Even though some organisms may exhibit resistance to antibiotics in vitro (Roland PS, and Stroman, 2002), when using antibiotics for ear infections, it is important to take each dose on schedule. Skipping or delaying doses can encourage resistant bacteria to develop.

Table 2. The Effect of Different Types of Antibiotics on Different Types of Bacteria Isolated.

Type of Antibiotics	Sensitivity and resistance of bacteria to Antimicrobial disk			
	Klebsiella pneumonia	*Pseudomonas spp*	*Pseudomonas aeruginosa*	*Enterobacter*
	Zone of inhibition			
Chloramphenicol	+++	+++	++	+++
Ciprofloxacin	+++	++	+	+++
Impenem	+++	+++	++	+
Ceftriaxone	+++	+++	-	-
Cefuroxime	+	+	+	+++
Ceftazidime	+++	+++	+	+
Augmentin	+++	+++	+	+
Tobramycin	++	+	++	+
Gentamycin	++	++	+	+
Amikacin	+++	+++	+	+++
Cefotaxime	-	-	-	-

Table 2. The Effect of Different Types of Antibiotics on Different Types of Bacteria Isolated.

Antibiotic	Zone of Inhibition (mm)	Effectiveness

Ceftriaxone	17-25	Highly effective
Imipenem	17-25	Highly effective
Levofloxacin	17-25	Highly effective
Chloramphenicol	17-25	Highly effective
Gentamycin	17-22	Effective
Amikacin	17-22	Effective
Ciprofloxacin	17-22	Good activity
Augmentin	10-15	Low effectiveness
Cloxacillin	<10	No effect
Ceftazidime	<10	No effect
Erythromycin	<10	No effect

Discussion:

In this study, we analyzed the prevalence and antibiotic susceptibility of bacterial isolates from patients with various infections in the casualty department at AL Safwa Clinic in Tripoli. Our findings indicate that Staphylococcus spp. were the most common bacterial isolates, followed by *Streptococcus spp*., *Pseudomonas aeruginosa*, *Proteus* spp., *Klebsiella pneumoniae*, and Escherichia coli. These results are consistent with previous studies on bacterial infections and antibiotic resistance.

Bacterial Prevalence: Staphylococcus spp. (37%) was the predominant isolate, similar to findings by Singh et al. (2016) and Gad et al. (2019), where *Staphylococcus aureus* was the most common pathogen in wound infections. *Streptococcus spp*. (36%) prevalence aligns with studies by Brook (2002) and O'Grady et al. (2019), emphasizing the role of *Streptococci* in respiratory and wound infections.

Pseudomonas aeruginosa (23%) was a significant isolate, comparable to results by Gupta et al. (2018) and El-Gayar et al. (2020), who reported a high prevalence of Pseudomonas in hospital-acquired infections.

Proteus spp. (10%) and *Klebsiella pneumoniae* (12%) were also identified, consistent with studies by Sahm et al. (2016) and Kanj et al. (2018), which highlighted these bacteria in urinary and respiratory infections. Escherichia coli (4%) was less common, which corresponds to findings by Khare et al. (2019) in similar clinical settings.

Antibiotic Susceptibility: Ceftriaxone, Imipenem, and Levofloxacin exhibited the highest inhibitory effects, corroborating studies by Li et al. (2017) and Paterson et al. (2020), which found these antibiotics effective against a broad range of bacteria.

Gentamycin and Amikacin also showed significant inhibition, which is consistent with findings by Zavascki et al. (2013) and Sun et al. (2018), who reported their efficacy against gram-positive bacteria. Ciprofloxacin was effective against most gram-negative bacteria, similar to studies by Owens et al. (2012) and Neuhauser et al. (2018), who reported its broad-spectrum activity. Chloramphenicol was notably effective against gram-positive bacteria, aligning with findings by Livermore et al. (2016) and Enne et al. (2019).

Low Efficacy Antibiotics:Augmentin, Cloxacillin, Ceftazidime, and Erythromycin showed low to no inhibitory effects, which agrees with studies by Wilcox et al. (2003) and Molton et al. (2013), highlighting rising resistance to these antibiotics in clinical isolates.

Implications and Resistance Trends: The resistance patterns observed, particularly for Cloxacillin, Ceftazidime, and Erythromycin, underscore the growing issue of antibiotic resistance, as reported by Ventola (2015) and Laxminarayan et al. (2020). Effective antibiotics like Ceftriaxone, Imipenem, and Levofloxacin should be considered first-line treatments in similar clinical settings, as suggested by the guidelines in studies by Harris et al. (2015) and Theuretzbacher et al. (2019).

Conclusion:

Our study aligns with numerous previous investigations, emphasizing the prevalence of *Staphylococcus* and *Streptococcus spp*. in infections and the continued efficacy of antibiotics like Ceftriaxone, Imipenem, and Levofloxacin. However, the rising resistance to older antibiotics highlights the need for ongoing surveillance and prudent antibiotic use.

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