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Research Article

Antimicrobial Susceptibility Pattern of Isolates of *Streptococcus pyogenes* obtained from Patients with Throat Infection

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I N F O

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A B S T R A C T

Background: Streptococcus Group A (GAS) or *Streptococcus pyogenes* are major causes of infectious diseases, including upper respiratory tract illnesses, especially throat infections. This infection involves the inflammation of pharyngitis. Recently, streptococcal species have shown a wide range of antimicrobial resistance.

Method: Sixty-four throat specimens were collected using a sterile broth tube and transferred to the bacteriological laboratory unit. These specimens were grown on different media and were then primarily identified using several types of biochemical tests and the process was completed through the VITEK 2 system for diagnosis of *Streptococcus pyogenes* and *Streptococcus spp*. The antibiotic susceptibility pattern of these bacterial isolates was identified on the Muller-Hinton Agar.

Results: The percentage of positive bacterial growth was equal to 55. The *Streptococcus pyogenes* growth was detected in 17.14% of the sample (66.67% in males and 33.33% in females). The antimicrobials levofloxacin, azithromycin, amikacin, norfloxacin, trimethoprim, erythromycin, and amoxicillin are effective against various samples of *Streptococcus pyogenes* with an efficacy of 66.67%.

Conclusion: Streptococcus pyogenes (GAS) is one of the major causes of throat infection. These infections are more common in males than females. The antimicrobials levofloxacin, azithromycin, amikacin, norfloxacin, trimethoprim, erythromycin, and amoxicillin are effective against *Streptococcus pyogenes*.

Keywords: Throat Infection, *Streptococcus pyogenes*, Antibiotics Susceptibility, Antimicrobial Resistance

Introduction

Infections of the respiratory tract include pharyngitis, acute bronchitis, acute sinusitis, community-acquired pneumonia, and acute otitis media. All of these represent important human health problems. These infections are a main health concern, especially in low-resource settings.[1] Group A *Streptococcus pyogenes* (GAS) is one of the main causes of acute respiratory tract illness. This pathogenic microorganism can lead to invasive infections, such as pharyngitis, pyoderma and autoimmune post-streptococcal illnesses, like glomerulonephritis and rheumatic fever.[2] Pharyngitis (sore throat) represents one of the major widespread conditions due to wrong practices of the family,[3] one such most important practice being the incorrect use of antibiotics. The recently seen increased antimicrobial resistance of the clinical isolates of *Streptococcus pyogenes* underscores the need for continued monitoring of the antibiotic resistance patterns of this pathogenic microorganism.[4–6] Hence, current treatment guidelines discourage the empirical use of the drug due to unnecessary antimicrobial exposure leading to the development of antibiotic resistance in bacteria.[7] The frequency of antibiotic resistance of the *Streptococcus pyogenes* (GAS) against various types of antibiotics has increased globally.[8]

Methodology

Samples

Sixty-four throat specimens were collected using a sterile broth tube, with a sterile wooden stick and were transferred to the bacteriological laboratory unit at the Hospital of Imam Ali in Babylon Province, through the period from January 2021 to December 2021 after obtaining the approval of the ethics committee and informed consent from participants. These specimens were grown on different media for the isolation of *Streptococcus pyogenes* and *Streptococcus* spp., and on Muller-Hinton Agar for the detection of antibiotic susceptibility patterns and analysed using the Excel and SPSS programmes.

Identification of *Streptococcus pyogenes* and *Streptococcus spp.*

The *Streptococcus pyogenes* and *Streptococcus* spp. specimens were grown on different media for activation. They were then primarily identified using several types of biochemical tests and the process was completed through the use of the VITEK 2 system.

Results

Sixty-four throat specimens were collected and were sent for the isolation and detection of *Streptococcus pyogenes* and *Streptococcus* spp. Positive bacterial growth was seen in 35 (55%) samples (Table 1). Table 2 shows that *Streptococcus pyogenes* growth was seen more in males as compared to females (66.67% and 33.33%, respectively, with overall infection seen in 17.14% of the sample). However, males and females showing growth of *Streptococcus* spp. were found to be 82.76% and 17.24% respectively, with an overall growth seen in 50% of the sample. Tables 3 and 4 show that the antibiotics levofloxacin, azithromycin, amikacin, norfloxacin, trimethoprim, erythromycin, and amoxicillin were effective against various samples of *Streptococcus pyogenes* with an efficacy percentage of 66.67%.

Table 1.Number and Percentage of Pathogenic Bacterial Isolates

S. No.	Growth	Number	Percentage
1.	Positive	35	55
2.	Negative	29	45
3.	Total	64	100

Table 2.Percentages of *Streptococcus pyogenes* and *Streptococcus* spp. according to Gender

Streptococcus pyogenes			
S. No.	**Growth**	**Male**	**Female**
1.	Positive (%)	66.67	33.33
2.	Negative (%)	96.55	3.45
Total			
1.	Positive (%)	17.14	
2.	Negative (%)	82.86	
Streptococcus spp.			
1.	Positive (%)	82.76	17.24
2.	Negative (%)	96.55	3.45
Total			
1.	Positive (%)	50	
2.	Negative (%)	50	

Table 3.Detection of the Antimicrobial Susceptibility Pattern of Pathogenic *Streptococcus pyogenes* and *Streptococcus spp.* Isolates

S. No.	Bacterial Type	Susceptible to Antimicrobials	Resistant to Antimicrobials
1	*Streptococcus pyogenes*	Levofloxacin, azithromycin and amikacin	Norfloxacin and ciprofloxacin
2	*Streptococcus pyogenes*	Amikacin, azithromycin, ciprofloxacin and gentamycin	Trimethoprim

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3	*Streptococcus pyogenes*	Amoxicillin, levofloxacin and ampicillin	Erythromycin and ciprofloxacin
4	*Streptococcus spp.*	Levofloxacin, azithromycin, and ciprofloxacin	Erythromycin, amoxicillin and ceftriaxone
Antibiotics Dosage (mg)			
Levofloxacin: 500, azithromycin: 500, amikacin: 500, azithromycin: 500, ciprofloxacin: 500, gentamycin: 80, amoxicillin: 500, azithromycin: 500, norfloxacin: 400, trimethoprim: 200, erythromycin: 500, ceftriaxone: 1000, ampicillin: 500			

Table 4. Antibiotic Activity Percentage Against Pathogenic *Streptococcus pyogenes* Isolates

Streptococcus pyogenes	
Antibiotic Type	**Sensitivity Percentage**
Levofloxacin	66.67
Azithromycin	66.67
Amikacin	66.67
Ciprofloxacin	33.33
Gentamycin	33.33
Amoxicillin	33.33
Ampicillin	33.33
Norfloxacin	66.67
Ciprofloxacin	33.33
Trimethoprim	66.67
Erythromycin	66.67
Amoxicillin	66.67
Antibiotics Dosage (mg)	
Levofloxacin: 500, azithromycin: 500, amikacin: 500, azithromycin: 500, ciprofloxacin: 500, gentamycin: 80, amoxicillin: 500, azithromycin: 500, norfloxacin: 400, trimethoprim: 200, erythromycin: 500, ceftriaxone: 1000, ampicillin: 500	

Discussion

The current study showed that males were more susceptible than females to *Streptococcus pyogenes* (66.67% in males and 33.33% in females, constituting infection in 17.14% of the sample), whereas the percentages were 82.76% and 17.24%, respectively for other *Streptococcus* spp., with the infection seen in overall 50% of the sample. In the research study by Rathod et al., it was seen that *Streptococcus pyogenes* isolates were obtained from 48% of males and 20% of females.[9] In a study by Hussein, the percentage of positive growth of the pathogenic gram-positive bacteria was found to be 46.0%, and for *S. pyogenes* and *Streptococcus* spp., the values were 37.50% and 33.33%, respectively. Males were found to be more susceptible to the infection than females (87.5% and 12.5%, respectively).[10] According to research studies which are dependent on gender, the rates of *Streptococcus pyogenes* (GAS) infection were higher in males than in females.[11–15] Lee et al. mentioned its main cause as the higher rate of physical interactions and poor personal hygiene among males.[13] However, very little is known about why the incidence of these infections is higher in males than in females. In the present study, the percentage of positive bacterial growth for all patients was 55%. In the research study by Rathod et al., the percentage of *Streptococcus pyogenes* was found to be 39.53%.[9] Berwal et al. illustrated in their study that among 50 specimens of throat swabs, 42 (84%) were positive for *Streptococcus* pyogenes.[16] Balla et al. showed that the percentage of GAS from throat swabs was equal to 25.5%.[17] About 30–40% of acute pharyngotonsillitis is caused by streptococci.[18,19] The current study showed that the antibiotics levofloxacin, azithromycin, amikacin, norfloxacin, trimethoprim, erythromycin, and amoxicillin are effective against various samples of *Streptococcus pyogenes* with the efficacy percentage equal to 66.67%. Also, *Streptococcus* spp. was found to be susceptible to levofloxacin, azithromycin and ciprofloxacin and resistant to erythromycin, amoxicillin and ceftriaxone. Camara et al. showed that all isolates of *S. pyogenes* were sensitive to amoxicillin, penicillin, and cephalosporins, and to macrolides except spiramycin. All isolates of this bacterium were resistant to tetracycline. Interestingly, the isolates were sensitive to vancomycin, teicoplanin, chloramphenicol, and levofloxacin.[1] In the research study of Kebede et al., the isolates of *S. pyogenes* from throat swabs were found to be sensitive to ampicillin and penicillin and resistant to levofloxacin, clindamycin, vancomycin, ceftriaxone, chloramphenicol, erythromycin, and tetracycline.[20] In the research study of Doğan et al., it was seen that the susceptibility percentages of *S. pyogenes* to penicillin, cefotaxime, linezolid, vancomycin, chloramphenicol, erythromycin, and clindamycin were 100%, 100%, 100%, 100%, 98.3%, 97.2%, and 94.7% respectively.[21] In a study by Hussein and Jarallah, the *S. pyogenes* isolates were found to be sensitive to trimethoprim.[22] Antibiotic susceptibility pattern showed that the *Streptococcus* spp. isolates were highly resistant to ciprofloxacin and gentamycin and were least resistant to doxycycline and cefotoxin.[23,24] However, in a study, the resistance rates of *Streptococcus* spp. to amoxicillin, amoxyclav, and clarithromycin were found to be 16.6%, 22.8%, and 19.2%, respectively.[25] Similar

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susceptibility patterns of *Streptococcus* spp. have been determined in other studies.[26] However, the variations seen in the antibiotic susceptibility patterns against these bacteria might be due to the types of antimicrobials, different geographical areas, varying origins of manufacturing companies, purchase without a proper prescription, prescription without laboratory confirmation, misuse like insufficient concentrations, improper duration, and different study regions and bacterial types.[27–30]

Conclusion

Streptococcus pyogenes (GAS) constitute a major cause of throat infection. These bacteria cause infections in males more than females. The antimicrobials levofloxacin, azithromycin, amikacin, norfloxacin, trimethoprim, erythromycin, and amoxicillin are effective against various samples of *Streptococcus pyogenes*.

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Conflict of Interest: None

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