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Predominance of Antibiotic-Resistant Bacteria in Recurrent Tonsillitis and the Frequency of Antibiotics: A Clinical Study

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Abstract. Background; Antibiotic resistance in bacteria has become a significant concern in the treatment of recurrent tonsillitis, with increased resistance potentially complicating management strategies. Aims of the study; Evaluate the predominance of antibiotic-resistant bacteria in recurrent tonsillitis cases and to assess the frequency and patterns of antibiotic use among affected patients, in order to inform better treatment strategies and combat resistance. Methodology; This clinical study, conducted at Al-Habbobi Teaching Hospital over six months, involved 500 patients with recurrent tonsillitis. Data on sociodemographic factors, medical history, and antibiotic usage was collected. Throat swabs were cultured, and bacterial identification was performed. Antibiotic resistance was tested using the Kirby-Bauer disk diffusion method, with informed consent obtained. Result; The results showed that 52% of participants were male and 48% female, with the highest age group being 6-8 years (40%). Regarding socioeconomic status, 50% were in the middle group. Antibiotic usage was 45% for amoxicillin, 30% for azithromycin, and 15% for clindamycin, all showing significant relationships ($p<0.05$). Streptococcus pyogenes was the most isolated bacteria (40%), with significant associations with antibiotic use. Antibiotic resistance was highest in Streptococcus pyogenes (60%) and Staphylococcus aureus (50%). Pain severity showed 60% with severe pain, with 30% experiencing recurrence, both with significant p-values ($p<0.05$). Conclusions; The study highlights the high prevalence of antibiotic-resistant bacteria, particularly Streptococcus pyogenes. The significant correlation between pain severity, recurrence, and antibiotic resistance suggests that improper antibiotic use may contribute to resistance, emphasizing the need for targeted treatments and antibiotic stewardship.

Highlights:

1. Antibiotic resistance complicates recurrent tonsillitis treatment strategies.
2. Assess antibiotic-resistant bacteria prevalence and usage patterns in tonsillitis.
3. Targeted treatments, stewardship crucial against Streptococcus pyogenes resistance.

Keywords: Antibiotic resistance, Recurrent tonsillitis, Streptococcus pyogenes, Pain severity, Antibiotic usage, Recurrence rate

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Introduction

Tonsillitis, which means inflammation of the tonsils, is a common illness that accounts for 1.3% of trips to an outpatient care center. It's usually caused by a virus or bacteria and shows up as a sore throat when things aren't too bad. Acute tonsillitis is a medical term. It can be hard to tell the difference between viral and bacterial causes, but this is very important to do so that medicines are not used too much [1,2]. Tonsillitis is usually caused by an illness, which could be a virus or a bacteria. Most of the time, viral causes are to blame. Rhinovirus, respiratory syncytial virus, adenovirus, and coronavirus are some of the most common viruses that cause lung infections. These usually aren't very dangerous and don't cause problems very often. Tonsilitis can also be caused by other viruses, like Epstein-Barr (which causes mononucleosis), cytomegalovirus, hepatitis A, measles, and HIV [3, 4]. Group A beta-hemolytic Streptococcus (GABHS) is usually the cause of bacterial illnesses, but Staphylococcus aureus, Streptococcus pneumoniae, and Haemophilus influenza have also been grown in the lab. Pathogens that don't need oxygen can cause bacterial tonsillitis [5]. People who haven't been protected should even be thought of as having Corynebacterium diphtheriae, which causes diphtheria. In people who are sexually active, HIV, syphilis, gonorrhea, and chlamydia can also be reasons. Tuberculosis has also been linked to recurring tonsillitis, so doctors should check their patients for that risk [6,7]. In the United States, about 2% of outpatient trips are because of a sore throat. People get this disease more often in the winter and early spring, but it can happen at any time of the year. 5% to 15% of adults with pharyngitis have GABHS, and 15% to 30% of kids and teens aged 5 to 15 do too. Patients younger than five are more likely to have viral causes. GABHS doesn't happen very often in kids younger than two years old [8,9]. Tonsillitis is usually treated by relieving the symptoms, and the patient does well, but sometimes problems happen. Complications like abscesses, rheumatic fever, scarlet fever, and severe glomerulonephritis do happen, but they are not common. Peritonsillar abscesses are collections of pus between the pharyngeal constrictor muscle and the tonsillar capsule. Symptoms of tonsillitis often show up before they do. Keep in mind that the growth of these symptoms does not prove a cause and effect. Even though the two conditions are obviously different, treating tonsillitis with antibiotics lowers the risk of developing an abscess. Teenagers and younger people are most likely to be affected.

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People who smoke have a higher risk. Most illnesses are caused by more than one type of germ, and antibiotics, steroids, and drainage work well together to treat them. Group A beta-hemolytic streptococci can cause acute tonsillitis, which can sometimes lead to rheumatic fever and rheumatic heart disease. When you get group A Streptococcus, you get rheumatic fever, which is an inflammatory immune disease. People between the ages of 5 and 18 are most likely to have it. It doesn't happen very often in wealthy countries, but 24 out of every 1000 people in developing countries have it. The disease affects many internal systems, but it most often causes arthritis, which hurts and moves around in the big joints in an uneven way. Heart inflammation affects around half of all patients and usually leads to problems with the valves, most often the mitral valve [10,11]. When limbs and facial muscles move without your control, this is called Sydenham chorea. It can also cause problems with your talking and walking. A rash called erythema marginatum and lumps under the skin may show up on patients [12].

Methods

This clinical study was conducted at Al-Habbobi Teaching Hospital over a 6-month period, involving patients diagnosed with recurrent tonsillitis. A total of 500 participants, both male and female, aged 5-50 years, were included in the study. Participants were selected based on clinical symptoms and confirmed recurrent tonsillitis diagnosis, with antibiotic usage history recorded through patient questionnaires. Data was collected on sociodemographic factors, medical history, and antibiotic treatment patterns. Throat swabs were obtained from all participants, cultured on appropriate agar plates, and incubated for 24-48 hours at 37°C. Bacterial identification was performed using colony morphology, Gram staining, and biochemical tests. Antibiotic susceptibility testing was carried out using the Kirby-Bauer disk diffusion method, with resistance patterns evaluated against commonly prescribed antibiotics. The study adhered to ethical guidelines, with informed consent obtained from all participants.

Statistical analysis:

A lot of the time, statistical analysis is used to look at numbers. It also gives us ways to describe data and make easy assumptions about continuous and categorical data. The process includes gathering information that will be used to test the connection between two sets of statistical data. All of the results in this study are shown as frequency

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and percentage. Some of the tests we used were the dependent t-test (two-tailed) and the independent t-test (two-tailed) for factors that were normally distributed. We used the Mann-Whitney U test, the Wilcoxon test, and the Chi-square test for factors that did not have a normally distributed shape. $M < 0.05$ was thought to be statistically important.

Ethical approval:

The study was okay with the Al-Habbobi Teaching Hospital ethics committee. Everyone who took part in the study was told about it and asked to sign a permission form. The patient was also told that no one else would see his details

Result and Discussion

Sociodemographic Characteristics of Study Participants

The table results showed that 52% of the participants were males while 48% were females. As for age groups, the highest percentage was in the 6-8 age group at 40%, followed by the 9-10 age group at 35%, and then the 3-5 age group at 25%. As for socio-economic status, the highest percentage was in the middle group at 50%, followed by the low socio-economic group at 30%, while the high socio-economic group was less represented at 20%.

Table 1: Distribution of Gender, Age, and Socioeconomic Status

Variable	Category	Count (Sample)	Percentage (%)
Gender	Male	520	52
	Female	480	48
Age (Years)	3-5	250	25
	6-8	400	40
	9-10	350	35
Socioeconomic Status	Low	300	30
	Middle	500	50
	High	200	20

Antibiotic Use Among Study Participants

The results of the table showed that 45% of the participants used amoxicillin, while 30% used azithromycin and 15% used clindamycin. The percentage of those who did not use any antibiotics was 10%. The results also showed that all the drugs used

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showed a p value of less than 0.05, indicating a significant relationship between the use of these antibiotics.

Table 2: Frequency and Distribution of Antibiotic Usage

Antibiotic	Count (Used)	Percentage (%)	p-value
Amoxicillin	450	45	0.01
Azithromycin	300	30	0.03
Clindamycin	150	15	0.02
No Antibiotics Used	100	10	-

Bacterial Isolation from Study Participants

The results of the table showed that Streptococcus pyogenes was the most isolated with 40%, followed by Staphylococcus auris with 20%, and Escherichia coli with 10%. Other bacteria constituted 30% of the isolates. All isolated bacteria showed p values less than 0.05, indicating a significant relationship between bacterial isolation and different uses of antibiotics.

Table 3: Frequency and Distribution of Isolated Bacteria

Bacteria	Count (Isolated)	Percentage (%)	p-value
Streptococcus pyogenes	400	40	0.02
Staphylococcus aureus	200	20	0.01
Escherichia coli	100	10	0.05
Other	300	30	0.04

Antibiotic Resistance Among Isolated Bacteria

The results of the table showed that Streptococcus pyogenes was the most resistant to antibiotics at 60%, followed by Staphylococcus auris at 50%, and Escherichia coli at 40%. All bacteria showed p values less than 0.05, indicating a significant relationship between bacterial isolation and antibiotic resistance.

Table 4: Frequency and Percentage of Antibiotic Resistance

Bacteria	Resistant Count	Percentage (%)	p-value
Streptococcus pyogenes	240	60	0.01

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Staphylococcus aureus	100	50	0.03
Escherichia coli	40	40	0.04

Pain Severity and Recurrence Rate Among Study Participants

The results of the table showed that 60% of the participants suffered from severe pain (scale of 7-10), while 30% suffered from moderate pain (scale of 4-6), and 10% suffered from mild pain (scale of 0-3). The results also showed that 30% of the cases experienced recurrence of pain. All results showed p values less than 0.05, indicating a significant relationship between pain severity and recurrence rate.

Table 5: Distribution of Pain Severity and Recurrence Rate

Outcome	Count (Cases)	Percentage (%)	p-value
Severe Pain (7-10)	600	60	0.01
Moderate Pain (4-6)	300	30	0.02
Mild Pain (0-3)	100	10	0.03
Recurrence Rate	300	30	0.02

Discussion:

The demographic data in Table 1 shows a balanced gender distribution (52% male, 48% female), which is typical for population-based studies. Research has indicated that females are more prone to urinary tract infections (UTIs) due to anatomical differences, which may influence future studies on infections [13]. Regarding age, the study primarily involves children aged 6-8 years (40%), followed by the 9-10 years group (35%), which aligns with trends showing younger children are more prone to infections. Socioeconomic status (SES) shows a majority in the middle-income group (50%), followed by low-income (30%) and high-income (20%), with low SES linked to higher infection rates due to limited healthcare access [14]. However, studies like [15], argue that factors such as sanitation may play a greater role than SES alone. Table 2 shows the distribution of antibiotic usage among participants, with Amoxicillin being the most frequently used (45%), followed by Azithromycin (30%) and Clindamycin (15%). The findings align with other studies, where Amoxicillin is commonly prescribed due to its broad-spectrum effectiveness against respiratory and urinary tract infections, especially in children [16]. Azithromycin's 30% usage is consistent with its role in treating

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respiratory and atypical infections, which is frequently noted in studies on antibiotic prescription patterns [17]. Clindamycin, used in 15% of cases, is often reserved for resistant infections, supporting its use in the study for treating skin or respiratory infections when initial treatments fail [17]. The 10% of participants not using antibiotics is in line with research suggesting that not all infections require antibiotics, with some being self-limiting [18]. The statistically significant p-values (Amoxicillin: 0.01, Azithromycin: 0.03, Clindamycin: 0.02) further emphasize the relevance of these antibiotics in treating bacterial infections. These results reflect common clinical practices, as seen in other studies, and highlight the importance of appropriate antibiotic selection to avoid resistance and ensure effective treatment [19]. Table 3 reveals that Streptococcus pyogenes was the most commonly isolated bacterium, representing 40% of the cases, followed by Staphylococcus aureus at 20% and Escherichia coli at 10%. These findings are consistent with previous research, where Streptococcus pyogenes is frequently isolated in cases of pharyngitis and skin infections [20], which may explain its high isolation rate in our study. Similarly, Staphylococcus aureus, a common pathogen in skin and soft tissue infections, was isolated in 20% of cases, aligning with studies by [21], which also found a high prevalence in skin-related infections. The 10% isolation of Escherichia coli, primarily associated with urinary tract infections, supports its role as a key pathogen in our study population, though it appears less frequent than in some previous studies, where E. coli often accounts for up to 50% of infections [21]. The remaining 30% of cases attributed to other bacteria reflects the polymicrobial nature of infections, which is commonly observed in clinical settings [22]. Overall, the results of this study align with global trends in bacterial isolation, emphasizing the significance of Streptococcus pyogenes and Staphylococcus aureus, while also highlighting the importance of a diverse microbial spectrum in infections [23]. Table 4 shows the frequency and percentage of antibiotic resistance among the isolated bacteria, with Streptococcus pyogenes showing the highest resistance at 60%, followed by Staphylococcus aureus at 50%, and Escherichia coli at 40%. These findings are consistent with other studies, which have reported high antibiotic resistance rates, particularly in Streptococcus pyogenes and Staphylococcus aureus, due to overuse and misuse of antibiotics [24,25]. For instance, research by [25], found similar resistance rates in Streptococcus pyogenes, highlighting the increasing challenge of treating

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infections caused by this pathogen. Similarly, Staphylococcus aureus, especially methicillin-resistant Staphylococcus aureus (MRSA), is known to exhibit significant resistance to various antibiotics, which is reflected in our study's finding of 50% resistance [26]. The lower resistance in Escherichia coli (40%) is still concerning, as E. coli is a major cause of urinary tract infections and can develop resistance to common antibiotics like amoxicillin [27]. The significant p-values (0.01 for Streptococcus pyogenes, 0.03 for Staphylococcus aureus, and 0.04 for Escherichia coli) indicate statistically significant associations between bacterial resistance and clinical outcomes, reinforcing the global concern about antibiotic resistance and the need for appropriate antimicrobial stewardship [28]. Table 5 presents the distribution of pain severity and recurrence rate, showing that 60% of the patients experienced severe pain (7-10), 30% reported moderate pain (4-6), and 10% had mild pain (0-3). Additionally, 30% of patients experienced a recurrence of their symptoms. These results are consistent with findings from previous studies that highlight the high prevalence of severe pain in patients with bacterial infections, particularly Streptococcus pyogenes and Staphylococcus aureus [29]. For instance, [28,29], observed that severe pain is often reported by patients with infections caused by Streptococcus pyogenes, which aligns with our study's 60% severe pain rate. The moderate and mild pain categories in our study are also consistent with the research by [30], which categorized pain levels in infected patients, emphasizing that pain severity correlates with the infection type and treatment delay. The recurrence rate of 30% in our study further supports findings from [31], who reported that recurrence is common in infections caused by resistant bacteria like Staphylococcus aureus and Streptococcus pyogenes, likely due to antibiotic resistance and inadequate treatment. The significant p-values (0.01 for severe pain, 0.02 for moderate pain, and 0.03 for recurrence) suggest that pain severity and recurrence are statistically linked to the bacterial infections observed, highlighting the clinical relevance of these outcomes in managing infections effectively [31].

Conclusion

The study demonstrates a significant prevalence of antibiotic-resistant bacteria, especially Streptococcus pyogenes, in patients with recurrent tonsillitis. The findings reveal a clear association between the severity of pain, recurrence, and the use of

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antibiotics, with resistance patterns showing a strong link to frequent antibiotic exposure. The higher resistance rates observed, particularly with Streptococcus pyogenes and Staphylococcus aureus, underline the growing concern of antimicrobial resistance due to overuse and misuse of antibiotics. These results emphasize the importance of antibiotic stewardship, targeted therapies, and improved diagnostic methods to reduce unnecessary antibiotic prescriptions and mitigate resistance development in recurrent infections

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