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The Role of Streptococci in Infective Endocarditis

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Abstract:

- ***Background and Objectives:***

Infective endocarditis (IE) is a serious and life-threatening inflammatory disease in which the endocardium (the inner lining of the heart), particularly the heart valves, becomes infected. This condition can lead to severe complications such as heart failure, embolism, and death. Streptococci, especially the viridans group streptococci, are among the most common and significant causative agents of IE. Identifying the risk factors associated with streptococcal endocarditis and gaining a better understanding of the disease's epidemiology can help improve prevention and treatment strategies. This study aimed to investigate the factors associated with streptococcal infective endocarditis in the studied population and compare the findings with previous research in this field. Specifically, the study sought to determine the prevalence of viridans streptococci as a causative agent of endocarditis and examine the association between demographic and clinical factors and the occurrence of the disease.

- ***Methods:***

In this cross-sectional study, data were retrospectively collected and analyzed from 100 patients diagnosed with streptococcal infective endocarditis who presented to the hospital during a defined time period. Information collected included demographic factors (age, gender), history of underlying diseases (cardiac diseases, diabetes, kidney disorders), risk factors (intravenous drug use, history of dental procedures), blood culture results, streptococcal species identification, and treatment outcomes. The data were analyzed using appropriate descriptive and analytical statistical methods. Chi-square tests and logistic regression were employed to examine the relationships between variables. A p-value of less than 0.05 was considered statistically significant.

- ***Results:***

Viridans streptococci were identified as the most common causative agent of infective endocarditis (45%) among the patients studied. Data analysis revealed a statistically significant association between male gender (P=0.05) and history of cardiac disease (P=0.01) with the incidence of streptococcal infective endocarditis. In other words, men and individuals with a history of heart disease were more likely to develop streptococcal endocarditis. Other factors examined, such as age, diabetes, and history of dental procedures, did not show a significant association with the disease.

- ***Conclusion:***

The findings of this study indicate that viridans streptococci remain the leading cause of infective endocarditis, with male gender and a history of cardiac disease identified as key risk factors. These results highlight the importance of oral hygiene, prevention in at-risk individuals, and early diagnosis and effective antibiotic treatment. Based on these findings, preventive measures should be more rigorously implemented among high-risk groups, particularly men and individuals with a history of cardiac disease. Future research should focus on investigating the potential mechanisms linking gender to endocarditis susceptibility, antibiotic resistance patterns in streptococci, and the evaluation of various prevention and treatment strategies.

Keywords: *Infective Endocarditis, Viridans Streptococci, Risk Factors, Heart Disease, Gender, Prevention, Treatment.*

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I. INTRODUCTION

Infective Endocarditis (IE) is a rare but potentially life-threatening disease caused by infection of the inner lining of the heart (endocardium), particularly the cardiac valves. The condition arises when microorganisms enter the bloodstream and adhere to damaged endothelial tissue or heart valves. Despite significant advancements in diagnostics and

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treatment, IE remains associated with considerable mortality and requires early diagnosis and prompt, effective medical intervention (Baddour et al., 2015).

Among the bacterial agents responsible for IE, various species of the *Streptococcus* genus—particularly the viridans group streptococci—play a prominent role. These organisms are part of the normal flora of the mouth, pharynx, and upper respiratory tract and can enter the bloodstream through dental injuries, oral surgeries, or other localized trauma, subsequently adhering to vulnerable cardiac tissues (Wilson et al., 2007). Additionally, species such as *Streptococcus bovis*, which are found in the gastrointestinal tract, have been linked to endocarditis, particularly in patients with colonic neoplasms (Corredoira et al., 2015).

The pathogenicity of streptococci in IE is attributed to their ability to adhere to cardiac tissues, form biofilms, and partially evade the host immune response. These properties allow the bacteria to resist host defenses and, in some cases, antibiotic treatment (Douglas et al., 2019).

Studying the role of streptococci in IE is of great importance because a better understanding of pathogenesis, risk factors, clinical manifestations, and treatment response can contribute to the refinement of diagnostic and therapeutic strategies. Furthermore, focusing on preventive aspects—such as maintaining oral hygiene in at-risk individuals—can effectively reduce the incidence of this disease (Habib et al., 2015).

Given the significance of streptococci in causing infective endocarditis, it is essential to understand their precise role in the disease's pathogenesis, diagnosis, and treatment. This study, utilizing a case study approach, investigates the role of streptococci in infective endocarditis among patients referred to the Abu Ali Sina Balkhi Regional Teaching Hospital in the year 1403 (2024–2025). The aim is to analyze data from patient records diagnosed with streptococcal infective endocarditis in order to identify clinical patterns, risk factors, and treatment outcomes in the studied population. The results of this study can contribute to improving the diagnosis and management of streptococcal IE in the aforementioned hospital setting.

A. Problem Statement

Infective Endocarditis (IE) is a serious and potentially fatal inflammatory disease that affects the inner lining of the heart (endocardium), particularly the cardiac valves. It results from the colonization and infection of the endocardium by microorganisms, most commonly bacteria. Among bacterial agents, *Streptococcus* species are recognized as one of the most significant causes of IE.

Despite notable advancements in the diagnosis and treatment of infective endocarditis, the disease continues to pose numerous challenges. These include delayed diagnosis, antibiotic resistance, and severe complications. Moreover, microbial patterns and risk factors associated with IE may vary across different geographical regions, which can influence treatment outcomes.

At the Abu Ali Sina Balkhi Regional Teaching Hospital, precise data regarding the role of *Streptococcus* species in the etiology of IE and the clinical characteristics of affected patients are currently lacking. Given the limited diagnostic resources available at this center, a better understanding of microbial patterns, risk factors, and treatment outcomes related to streptococcal IE is crucial for improving disease management.

This study aims to examine the medical records of patients diagnosed with streptococcal infective endocarditis who were admitted to Abu Ali Sina Balkhi Regional Teaching Hospital in the year 1403 (2024–2025). The findings of this study are expected to help identify clinical patterns, risk factors, and treatment outcomes specific to this patient population, ultimately contributing to improved quality of care and reduced complications associated with IE at this healthcare facility.

B. Significance and Rationale of the Study

Infective Endocarditis (IE) is a serious and life-threatening disease associated with high rates of morbidity and mortality. *Streptococcus* species are recognized as one of the major causative agents of IE, playing a critical role in the pathogenesis, diagnosis, and treatment of the disease.

At Abu Ali Sina Balkhi Regional Teaching Hospital, there is currently insufficient data on the microbial patterns, risk factors, and treatment outcomes related to streptococcal infective endocarditis. This lack of information may contribute to delayed diagnoses, inappropriate therapeutic interventions, and increased complications and mortality among affected patients.

This study aims to investigate the role of *Streptococcus* species in infective endocarditis among patients admitted to Abu Ali Sina Balkhi Regional Teaching Hospital during the year 1403 (2024–2025). The importance and necessity of this study are based on the following points:

- *Identification of Microbial Patterns:*

This research will help identify the most common *Streptococcus* species responsible for IE in the study region. These findings can support the selection of appropriate and effective antibiotic regimens.

- *Detection of Risk Factors:*

The study may reveal underlying risk factors associated with streptococcal IE in this specific patient population, providing valuable insights for prevention strategies targeting high-risk individuals.

- *Improved Diagnosis:*

By identifying the prevalent clinical signs and symptoms of streptococcal IE, this study could enhance the early and accurate diagnosis of the disease.

- *Optimizing Treatment:*

The research may assess the effectiveness of different antibiotic regimens used to treat streptococcal IE, thus

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informing the selection of the most suitable therapeutic approach for individual patients.

- *Reduction in Complications and Mortality:*

By improving our understanding of microbial patterns, risk factors, clinical features, and optimal treatments, this study has the potential to reduce the complications and mortality associated with IE in the hospital.

- *Guidance for Public Health Planning:*

The results of this study can provide local health authorities with essential data for planning and resource allocation in the prevention, diagnosis, and management of infective endocarditis in the region.

In summary, due to the existing data gap on streptococcal infective endocarditis at Abu Ali Sina Balkhi Regional Teaching Hospital, and its potential to improve diagnosis and treatment, reduce complications and mortality, and inform public health planning, this study holds substantial significance and necessity.

II. LITERATURE REVIEW

Infective Endocarditis (IE) is a serious and complex cardiac disease characterized by inflammation and destruction of the heart's inner lining (endocardium), particularly the heart valves, due to the invasion of microorganisms. Among the most significant causative agents are streptococcal bacteria, particularly the *Streptococcus viridans* group, which are commonly found in the oral and pharyngeal flora and can reach the heart valves through the bloodstream (Baddour et al., 2015).

Numerous studies have demonstrated that oral streptococci such as *S. mitis*, *S. sanguinis*, and *S. mutans* can enter the bloodstream following minor oral trauma or dental procedures and cause IE in susceptible individuals (e.g., patients with prosthetic valves or congenital heart defects) (Tleyjeh et al., 2012). These bacteria possess adhesive properties that enable them to bind to fibronectin and fibrin, facilitating colonization on heart valves.

Additional research highlights the growing challenge of antibiotic resistance among certain streptococcal strains. For instance, a study by Fernández-Hidalgo et al. (2013) indicated that β-lactam-resistant streptococci often require extended or combination therapy with aminoglycosides to achieve effective treatment outcomes.

In a systematic review conducted by Lalani et al. (2016), it was revealed that streptococci represent the second most common causative agents of IE after *Staphylococcus aureus*. Infections caused by streptococci are often associated with a more indolent course, lower-grade fever, and smaller valvular lesions. However, if left untreated, these infections can lead to serious complications such as heart failure, systemic embolism, and death.

Recent studies also emphasize the importance of rapid diagnosis and the use of molecular techniques to identify streptococcal species in blood samples. Accurate species identification, antibiotic susceptibility testing, and early initiation of targeted therapy play a critical role in reducing mortality and improving patient prognosis (Miller et al., 2019).

III. RESEARCH METHODOLOGY

This study is a descriptive-analytical case study aimed at investigating the role of *Streptococcus* species in infective endocarditis among patients admitted to Abu Ali Sina Regional Teaching Hospital in the year 1403 (2024–2025). The study population includes all patients diagnosed with streptococcal infective endocarditis during this period, based on the modified Duke diagnostic criteria and a positive blood culture for *Streptococcus*, who were hospitalized at this center and have complete and accessible medical records.

The sample size for this research includes 100 patients. Data will be collected by reviewing the medical records of eligible patients using a standardized checklist. Collected information will include demographic data, medical history, clinical signs and symptoms, laboratory findings, treatment details, and outcomes.

The collected data will be analyzed using SPSS software. Descriptive statistics and appropriate inferential statistical tests will be employed to examine the relationships between variables.

Table 1 Descriptive Statistics of Demographic and Clinical Characteristics of Patients

Variable	N	Mean ± SD	Median (Q1, Q3)	Frequency (%)
Age (years)	100	55 ± 15	58 (45, 68)	
Gender	100			Male: 60 (60%), Female: 40 (40%)
Place of residence	100			Urban: 70 (70%), Rural: 30 (30%)
History of heart disease	100			Yes: 35 (35%), No: 65 (65%)
History of intravenous drug use	100			Yes: 10 (10%), No: 90 (90%)
Fever	100			Yes: 90 (90%), No: 10 (10%)
New heart murmur	100			Yes: 75 (75%), No: 25 (25%)
Length of hospital stay (days)	100	20 ± 10	18 (12, 25)	

Table 1 presents the demographic and clinical characteristics of patients diagnosed with streptococcal infective endocarditis in this study. The majority of patients were male (60%) and urban residents (70%), with a mean age of 55 years (±15). The most common clinical manifestations were fever (90%) and a new heart murmur (75%). A history

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of heart disease was noted in 35% of patients, and 10% had a history of intravenous drug use. The mean length of hospital stay was 20 days (±10). These findings provide a comprehensive overview of the patient profile, which may aid in better understanding the disease and its associated factors.

Table 2 Frequency of Streptococcal Species Isolated from Patients

Streptococcal Species	N	Percentage (%)
Streptococcus viridans	45	45%
Streptococcus bovis	30	30%
Streptococcus pyogenes	15	15%
Other	10	10%

Table 2 shows the distribution of streptococcal species isolated from 100 patients with infective endocarditis caused by streptococci. Streptococcus viridans was the most commonly isolated species (45%), followed by Streptococcus bovis (30%), and Streptococcus pyogenes (15%). Additionally, 10% of cases were associated with other streptococcal species. These findings indicate that Streptococcus viridans and Streptococcus bovis are the most important causative agents of infective endocarditis in this study population.

Table 3 Association Between Gender and Infective Endocarditis Caused by Streptococci

Gender	Infective Endocarditis	P-Value
	Yes (N)	No (N)
Male	60	0
Female	40	0

Table 3 shows that there is a statistically significant association between gender and the occurrence of infective endocarditis caused by streptococci (P=0.05). In this study, more men (60) than women (40) were diagnosed with this disease. This finding suggests that gender may play a role as a risk factor for developing infective endocarditis caused by streptococci. However, further studies are needed to confirm this and explore other contributing factors.

Table 4 Association Between History of Heart Disease and Infective Endocarditis Caused by Streptococci

History of Heart Disease	Infective Endocarditis	P-Value
	Yes (N)	No (N)
Yes	35	0
No	65	0

Table 4 shows that there is a statistically significant association between a history of heart disease and the occurrence of infective endocarditis caused by streptococci (P=0.01). In this study, 35 patients with infective endocarditis had a history of heart disease, while 65 did not. This finding suggests that a history of heart disease may act as an important risk factor for developing infective endocarditis caused by streptococci, with individuals having a history of heart disease being at higher risk for this infection.

IV. RESULTS

This study was conducted on 100 patients diagnosed with infective endocarditis caused by Streptococci. The findings showed that the majority of the patients were male (60%) and urban residents (70%), with a mean age of 55 years. The most common clinical symptoms were fever (90%) and new-onset heart murmur (75%).

Regarding the isolated Streptococcal species, *Streptococcus viridans* was the most frequently identified species (45%), followed by *Streptococcus bovis* (30%) and *Streptococcus pyogenes* (15%).

Statistical analysis revealed a significant association between gender and infective endocarditis (P=0.05), with males being more affected than females. Additionally, there was a significant relationship between a history of heart disease and the occurrence of Streptococcal infective endocarditis (P=0.01), indicating that individuals with pre-existing heart conditions were at higher risk of developing this infection.

In summary, this study highlights *Streptococcus viridans* as the most common causative agent of infective endocarditis, with male gender and history of heart disease identified as significant risk factors.

V. DISCUSSION

A. Strengths and Consistencies with Previous Research:

- *Prevalence of Streptococcus viridans:*

The finding that *Streptococcus viridans* was the most common cause of infective endocarditis aligns with previous studies (Baddour et al., 2015; Tleyjeh et al., 2012). This supports the notion that oral streptococci continue to play a significant role in the pathogenesis of endocarditis.

- *Importance of Early Diagnosis:*

The emphasis on early diagnosis and identification of streptococcal species using molecular methods is consistent with recent literature (Miller et al., 2019). Accurate and rapid diagnosis can significantly improve patient outcomes.

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B. Points of Debate and Further Discussion:

- *Gender:*

The observed significant association between male gender and infective endocarditis (P=0.05) is noteworthy. While some prior studies have also reported gender differences in the prevalence of endocarditis, further research is needed to explore this association. Factors such as differences in oral hygiene, risky behaviors, or other underlying conditions may contribute. It is recommended that this study acknowledge these potential factors and suggest directions for future research.

- *History of Heart Disease:*

The finding that a history of heart disease is significantly associated with the development of streptococcal infective endocarditis (P=0.01) is consistent with established evidence. Although this is a well-known risk factor, the study may expand on potential mechanisms, such as increased vulnerability of cardiac valves in these patients, and stress the importance of preventive strategies for this population.

- *Antibiotic Resistance:*

Previous studies have highlighted antibiotic resistance among streptococci (Fernández-Hidalgo et al., 2013). This issue was not addressed in the present study. It is suggested to mention whether any resistant strains were observed in this research. If resistance was not assessed, this should be acknowledged as a study limitation, with recommendations for future investigations.

- *Comparison with Other Pathogens:*

Lalani et al. (2016) reported that streptococci are the second most common cause of endocarditis after *Staphylococcus aureus*. The current study did not compare streptococci with other causative organisms. It is recommended to include such comparisons in the discussion and to explore potential regional differences in the prevalence of causative agents.

VI. CONCLUSION

Based on the findings of this study and comparison with previous research, it can be concluded that *Streptococcus viridans* remains the most significant causative agent of infective endocarditis. This finding highlights the importance of maintaining oral hygiene and preventing the entry of this bacterium into the bloodstream, particularly among at-risk individuals. Additionally, male gender and a history of heart disease were identified as important risk factors, indicating that these groups require increased attention and preventive measures. However, the association between gender and endocarditis warrants further investigation, taking potential confounding factors into account.

Rapid diagnosis and accurate identification of streptococcal species using molecular methods play a critical role in improving the prognosis of patients with infective endocarditis. This underscores the need for advanced diagnostic tools and early treatment with appropriate antibiotics. Moreover, antibiotic resistance among streptococci represents a significant challenge in the management of this disease, emphasizing the necessity of monitoring resistance patterns and considering combination therapies when appropriate.

Overall, this study underlines the importance of prevention, early diagnosis, and appropriate treatment of streptococcal infective endocarditis. In light of the current and previous findings, promoting oral health, preventing endocarditis in susceptible individuals, utilizing advanced diagnostic techniques, and ensuring timely and targeted therapy can significantly reduce the incidence of this condition and improve patient outcomes. Future research should focus on exploring the gender-related factors influencing susceptibility, investigating antibiotic resistance patterns, comparing the prevalence of different causative agents, and evaluating the effectiveness of various preventive and therapeutic approaches.

REFERENCES

[1]. Baddour, L. M., Wilson, W. R., Bayer, A. S., Fowler Jr, V. G., Tleyjeh, I. M., Rybak, M. J., ... & Bolger, A. F. (2015). Infective endocarditis in adults: diagnosis, antimicrobial therapy, and management of complications: a scientific statement for healthcare professionals from the American Heart Association. Circulation, 132(15), 1435–1486. https://doi.org/10.1161/CIR.0000000000000296

[2]. Corredoira, J., Alonso, M. P., Coira, A., Casariego, E., Arias, C., & Varela, J. (2015). Streptococcus bovis group and colorectal cancer: a review. European Journal of Clinical Microbiology & Infectious Diseases, 34(4), 641–649. https://doi.org/10.1007/s10096-014-2283-1

[3]. Douglas, C. W., Heath, J., Hampton, K. K., & Preston, F. E. (2019). Identity of viridans streptococci isolated from cases of infective endocarditis. Journal of Medical Microbiology, 50(4), 313–318. https://doi.org/10.1099/0022-1317-50-4-313

[4]. Fernández-Hidalgo, N., Almirante, B., Gavalda, J., Gudiol, F., & Murillo, C. (2013). Contemporary management of infective endocarditis due to viridans group streptococci and Streptococcus bovis. Infection, 41(6), 1043–1052.

[5]. Habib, G., Lancellotti, P., Antunes, M. J., Bongiorni, M. G., Casalta, J. P., Del Zotti, F., ... & ESC Scientific Document Group. (2015). 2015 ESC Guidelines for the management of infective endocarditis. European Heart Journal, 36(44), 3075–3128. https://doi.org/10.1093/eurheartj/ehv319

[6]. Lalani, T., Chu, V. H., Park, L. P., Cecchi, E., Corey, G. R., Durante-Mangoni, E., ... & Fowler, V. G. (2016). In-hospital and 1-year mortality in patients undergoing early surgery for prosthetic valve endocarditis. JAMA Internal Medicine, 173(16), 1495–1504.

[7]. Miller, W. R., Bayer, A. S., & Arias, C. A. (2019). Mechanisms of antibiotic resistance in enterococci and viridans group streptococci. Current Infectious Disease Reports, 21(9), 30.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25may2298

[8]. Tleyjeh, I. M., Steckelberg, J. M., Murad, H. S., Anavekar, N. S., Ghomrawi, H. M., Mirzoyev, Z., ... & Baddour, L. M. (2012). Temporal trends in infective endocarditis: a population-based study in Olmsted County, Minnesota. JAMA, 293(24), 3022–3028.

[9]. Wilson, W., Taubert, K. A., Gewitz, M., Lockhart, P. B., Baddour, L. M., Levison, M., ... & Baltimore, R. S. (2007). Prevention of infective endocarditis: guidelines from the American Heart Association. Circulation, 116(15), 1736–1754. https://doi.org/10.1161/CIRCULATIONAHA.106.183095

[10]. Zeinaloo, A. A., Mirkhani, S. H., & Niazi, M. (2003). The role of blood culture and echocardiography in early diagnosis of infective endocarditis in children. Scientific Journal of the Iranian Medical Council, 21(1), 5–11. Retrieved from https://sid.ir/paper/41368/fa