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## SCARLET FEVER IN INDIA: RE-EMERGENCE, CLINICAL PROFILE, AND PUBLIC HEALTH IMPLICATIONS

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### ABSTRACT

**Background:** Scarlet fever, caused by Group A Streptococcus (GAS), has shown a global resurgence in recent years following the COVID-19 pandemic. In India, this re-emergence presents significant public health challenges due to the country's large pediatric population and healthcare access disparities. **Objective:** This study aims to analyze the re-emergence patterns, clinical profile, and public health implications of scarlet fever in India, with emphasis on changing epidemiology, antimicrobial resistance, and prevention strategies. **Methods:** A comprehensive review of literature on GAS infections and scarlet fever was conducted, focusing on epidemiological data from India and comparable regions. WHO guidelines, national protocols, and recent studies on GAS infections published between 2015- 2025 were analyzed. **Results:** Recent data indicates a significant increase in scarlet fever cases in India following the COVID-19 pandemic, mirroring global trends. The clinical profile shows the classic triad of fever, pharyngitis, and sandpaper rash, with complications including rheumatic heart disease disproportionately affecting lower socioeconomic populations. Antimicrobial resistance patterns show concerning trends with increasing macrolide resistance. **Conclusion:** The re-emergence of scarlet fever in India necessitates enhanced surveillance, antimicrobial stewardship, and public health interventions. Vaccine development efforts represent a promising avenue for future control strategies.

**KEYWORDS:** Scarlet fever, Group A Streptococcus, India, re-emergence, antimicrobial resistance, public Health.

### Global Burden of Scarlet Fever

Scarlet fever, a toxin-mediated disease caused by Group A Streptococcus (GAS), has historically been a significant cause of childhood morbidity and mortality worldwide. After decades of declining

incidence in many parts of the world, scarlet fever has shown a concerning resurgence in the past decade, with notable outbreaks in countries including China, the United Kingdom, and parts of Europe. This re-emergence has been characterized by changing epidemiological patterns and, in some cases, increased virulence of circulating strains.

### Epidemiology of Scarlet Fever in India

In India, the epidemiology of scarlet fever has been poorly documented compared to other infectious diseases. Historically, the disease has been endemic with seasonal variations, primarily affecting children between 5-15 years of age. However, comprehensive surveillance data has been limited, leading to potential underestimation of disease burden. Recent observations suggest an increase in cases following the COVID-19 pandemic, consistent with global trends of GAS infection resurgence after the relaxation of pandemic-related public health measures. Impact of GAS Infections in Low and Middle-Income Countries Group A Streptococcus is responsible for a wide spectrum of diseases, from mild pharyngitis to severe invasive infections and post-infectious immune-mediated complications. The global burden of GAS infections is substantial, affecting over 800 million individuals annually and resulting in approximately 639,000 deaths due to complications related to Rheumatic Heart Disease (RHD). These complications disproportionately impact low- and middle-income countries (LMICs) like India, where access to timely diagnosis and treatment may be limited.

### Changing Patterns and Emergence of New Strains

The resurgence of scarlet fever globally has been associated with the emergence of new GAS strains, such as M1UK, which demonstrate increased virulence and toxin production. Additionally, changing patterns of antimicrobial resistance, particularly to macrolides and clindamycin, have raised concerns about treatment efficacy. In India, the diversity of circulating emm types (which encode the M protein, a major virulence factor) presents challenges for vaccine development and control strategies.

### Knowledge Gaps and Rationale for the Study

Despite the potential public health significance of scarlet fever in India, there remains a paucity of data regarding its current epidemiology, clinical profile, and public health impact. Understanding these aspects is crucial for developing effective prevention and control strategies, particularly in the context of changing disease patterns and antimicrobial resistance.

**Objectives of the Study** This study aims to:

Analyze the re-emergence patterns of scarlet fever in India, with particular focus on post-COVID-19 pandemic trends

Characterize the clinical profile and presentation of scarlet fever in the Indian context

Evaluate the public health implications, including burden of disease, complications, and challenges in diagnosis and management

Assess current prevention and control strategies, including the potential role of vaccine development

**Methods**

**Study Design** This is a comprehensive review article analyzing the re-emergence, clinical profile, and public health implications of scarlet fever in India. The study employs a systematic approach to synthesize available evidence from multiple sources.

**Data Sources**

The following data sources were utilized:

PubMed, Scopus, and Web of Science databases for peer-reviewed literature Indian Council of Medical Research (ICMR) reports and publications

World Health Organization (WHO) guidelines and technical reports National Center for Disease Control (NCDC) surveillance data Hospital-based studies from tertiary care centers across India

Global data from comparable settings for contextual comparison

**Inclusion criteria:**

Studies published between 2015 and 2025

Research focusing on scarlet fever and GAS infections in India or comparable settings Publications in English or with available English translations

Case series, epidemiological studies, clinical trials, and review articles

**Exclusion criteria:**  
Case reports with fewer than 5 patients

Studies without clear methodological descriptions Publications without peer review

Duplicate publications

**Search Strategy**

A comprehensive search strategy was developed using the following key terms and their combinations:

“Scarlet fever” OR “Scarlatina” AND “India” “Group A Streptococcus” OR “Streptococcus pyogenes” AND “India”

“Re-emergence” OR “Resurgence” AND “Scarlet fever” “Clinical profile” OR “Clinical features” AND “Scarlet fever”

Antimicrobial resistance” AND “Group A Streptococcus” AND “India” “Public health” AND “Scarlet fever” AND “India”

Data Extraction and Analysis Data extraction was performed using a standardized form to collect information on: Epidemiological patterns and trends Clinical features and presentation

Treatment protocols Antimicrobial resistance patterns Complications and outcomes Public health interventions

Extracted data was synthesized narratively, with quantitative data presented in tables and figures where appropriate.

Ethical Considerations

As this study involves the review of published literature and publicly available data, no formal ethical approval was required. However, all sources are appropriately cited, and data interpretation acknowledges limitations and potential biases.

## **R — RESULTS**

Epidemiological Trends of Scarlet Fever in India Temporal Patterns and Re-emergence

Analysis of available surveillance data indicates a significant decline in scarlet fever cases during the early COVID-19 pandemic (2020-2021), followed by a marked resurgence in late 2022 and early 2023. This pattern mirrors global trends observed in countries like the United Kingdom, France, and the United States, where GAS infections, including scarlet fever, showed a sharp increase following the relaxation of pandemic-related public health measures.

Age and Demographic Patterns

Consistent with global patterns, scarlet fever in India predominantly affects children aged 5-10 years, with a slightly higher incidence in males compared to females. Children under three years show relative protection, possibly due to maternal antibodies, while adolescents and adults account for approximately 15% of cases.

Seasonal Variations

Scarlet fever in India demonstrates seasonal patterns, with peak incidence during winter and early spring months (December to March). This seasonality aligns with patterns of GAS pharyngitis and may be influenced by factors such as school attendance and indoor crowding during colder months.

Clinical Profile of Scarlet Fever in Indian Patients Presenting Symptoms and Signs

The clinical presentation of scarlet fever in Indian patients is characterized by: Sudden onset of high fever ( $>38.5^{\circ}\text{C}$ )

Severe sore throat with exudative pharyngitis

Characteristic “sandpaper” rash appearing 12-48 hours after fever onset Circumoral pallor with flushed cheeks

Strawberry tongue” progressing from white to Tender cervical lymphadenopathy

Pastia lines (linear petechiae in skin folds)

Additional symptoms frequently reported include headache, nausea, vomiting, and abdominal pain, particularly in younger children.

#### Laboratory Findings

Common laboratory findings include: Leukocytosis with neutrophil predominance Elevated C-reactive protein and erythrocyte sedimentation rate Positive throat culture or rapid antigen detection test for GAS Anti-streptolysin O (ASO) titer elevation in follow-up testing Clinical Variants and Atypical Presentations

Several atypical presentations have been documented in Indian patients: Scarlet fever without exudative pharyngitis

Scarlatiniform rash associated with GAS skin infections

#### Complications

Complications observed in Indian patients include:

Suppurative complications: peritonsillar abscess, otitis media, sinusitis

Non-suppurative complications: acute rheumatic fever, rheumatic heart disease, poststreptococcal glomerulonephritis

Rare severe complications: toxic shock syndrome, necrotizing fasciitis

The incidence of rheumatic heart disease as a complication of GAS infections remains significantly higher in India compared to high-income countries, highlighting the importance of early diagnosis and treatment.

#### Microbiological Characteristics and Antimicrobial Resistance Circulating emm Types

Limited molecular epidemiological studies from India have identified diverse emm types associated with scarlet fever, with emm1, emm12, emm3, and emm4 being most common. Recent data suggests an increasing prevalence of emm1 strains, similar to trends observed in other countries experiencing scarlet fever resurgence.

#### Toxin Production

Scarlet fever in India is associated with GAS strains producing pyrogenic exotoxins, primarily SpeA, SpeB, and SpeC. Recent isolates show a higher frequency of multiple toxin gene carriage compared to

historical samples. Antimicrobial Resistance Patterns Concerning trends in antimicrobial resistance have been observed: Penicillin remains universally effective against GAS in India.

Macrolide resistance has increased significantly, with rates of 20-40% reported in recent studies  
Tetracycline resistance exceeds 50% in most regions

Clindamycin resistance is emerging, particularly in urban centers

Multidrug-resistant strains carrying multiple resistance determinants are increasingly reported  
Public Health Implications

Disease Burden and Healthcare Utilization

Scarlet fever contributes significantly to pediatric outpatient visits and hospitalizations during peak seasons. Limited data suggests an estimated annual incidence of 5-10 cases per 100,000 population, though this likely underestimates the true burden due to underreporting.

Economic Impact

The economic impact includes direct healthcare costs and indirect costs from school absenteeism and parental work loss. Additionally, the long-term economic burden of complications, particularly rheumatic heart disease, is substantial.

Challenges in Diagnosis and Management Key challenges identified include:

Limited access to laboratory confirmation in resource-constrained settings  
Empiric antibiotic use leading to potential overtreatment  
Incomplete treatment courses contributing to complications and resistance

Lack of awareness among healthcare providers about the re-emergence of scarlet fever  
Current Prevention and Control Strategies Existing strategies focus on:

Early diagnosis and appropriate antibiotic treatment

Contact precautions to prevent transmission in healthcare and school settings  
Limited surveillance through existing communicable disease reporting systems  
Public and healthcare provider education

## **D — DISCUSSION**

Interpretation of Key Findings

The re-emergence of scarlet fever in India following the COVID-19 pandemic represents a significant public health concern. This resurgence mirrors global trends and may be attributed to several factors, including the relaxation of pandemic-related public health measures, changes in population immunity, and potential shifts in GAS strain virulence and transmissibility.

The clinical profile of scarlet fever in Indian patients largely aligns with classical descriptions, though the frequency of complications, particularly rheumatic heart disease, appears higher than in

high-income countries. This disparity likely reflects broader socioeconomic determinants of health, including delayed diagnosis, incomplete treatment, and limited access to healthcare.

The increasing prevalence of antimicrobial resistance, particularly to macrolides and clindamycin, raises concerns about future treatment efficacy. While penicillin remains the treatment of choice, alternatives for penicillin-allergic patients are becoming more limited, highlighting the need for antimicrobial stewardship and resistance monitoring.

#### Comparison with Global Trends

The epidemiological patterns observed in India share similarities with global trends, including the post-pandemic resurgence and the increasing prevalence of specific emm types, particularly emm1. However, India faces unique challenges related to its large population, healthcare access disparities, and higher burden of complications like rheumatic heart disease.

The antimicrobial resistance patterns in India show intermediate levels compared to global data, with resistance rates higher than those reported in Europe and North America but lower than the extremely high rates documented in China and parts of East Asia.

#### Strengths and Limitations of the Study

##### Strengths:

Comprehensive review of available literature and data sources  
Integration of global context with India-specific information

Multifaceted analysis covering epidemiology, clinical features, and public health aspects

Limitations:  
Limited availability of systematic surveillance data from India

Potential reporting and publication bias in available studies  
Heterogeneity in diagnostic approaches across different studies

Limited molecular epidemiological data on circulating strains

Implications for Clinical Practice  
The findings have several implications for clinical practice:

Increased awareness of scarlet fever's re-emergence is needed among healthcare providers  
Early recognition of the characteristic clinical features is crucial for timely diagnosis  
Appropriate antibiotic therapy, preferably with penicillin, should be promptly initiated  
Complete treatment courses must be emphasized to prevent complications

Vigilance for potential complications, particularly in high-risk populations

Implications for Public Health Policy  
From a public health perspective, the findings suggest the need for: Enhanced surveillance systems for GAS infections, including scarlet fever

Antimicrobial resistance monitoring programs

Public awareness campaigns about symptoms and the importance of seeking medical care  
School-based prevention strategies, including hygiene education and exclusion policy  
School-based prevention strategies, including hygiene education and exclusion policies

Consideration of GAS vaccine development as a long-term prevention strategy  
Future Research Directions

Several key areas for future research emerge from this analysis: Comprehensive epidemiological studies to accurately determine disease burden  
Molecular surveillance of circulating GAS strains and resistance determinants  
Evaluation of point-of-care diagnostic tests suitable for resource-limited settings  
Assessment of the effectiveness of public health interventions

Cost-effectiveness analyses of potential vaccination strategies

Investigation of host and pathogen factors influencing disease severity and complications.

## **CONCLUSION**

The re-emergence of scarlet fever in India represents a significant public health challenge that requires coordinated clinical and public health responses. The disease predominantly affects school-aged children and presents with characteristic clinical features that facilitate diagnosis when healthcare providers maintain appropriate awareness and vigilance.

The higher burden of complications, particularly rheumatic heart disease, underscores importance of early diagnosis and complete treatment. Rising antimicrobial resistance, though not yet affecting penicillin efficacy, necessitates ongoing surveillance and stewardship efforts. Public health strategies should focus on enhanced surveillance, healthcare provider education, public awareness, and consideration of future vaccination programs. The development of an effective GAS vaccine represents a promising avenue for long-term control and prevention.

Addressing the re-emergence of scarlet fever in India requires a multifaceted approach that integrates clinical care, public health interventions, and research efforts. Such a comprehensive strategy will be essential for mitigating the impact of this re-emerging infectious disease on the Indian population, particularly its most vulnerable members.

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