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Clinical, laboratory profile of acute rheumatic fever in children: At tertiary center

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Abstract
Introduction: Acute rheumatic fever (ARF) is an inflammatory disease that often follows Group A Streptococcal infection. It predominantly affects children, especially in areas with limited access to healthcare. This study aims to evaluate the clinical and laboratory profiles of children diagnosed with ARF.
Material and Methods: A cohort of 75 children diagnosed with ARF was assessed for inflammatory markers, complete blood counts, and evidence of a preceding Group A Streptococcal infection.
Results: The mean values for erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), markers of inflammation, were elevated, suggesting ongoing inflammation. The white blood cell (WBC) count was also increased, indicative of an immune response to infection. Despite the infection and inflammation, the average hemoglobin level was within the typical range for children. The platelet count varied widely among patients, while antistreptolysin O (ASO) titers, indicative of a recent Group A Streptococcal infection, were elevated.
Conclusion: The findings confirm the inflammatory nature of ARF in children and support the association with a preceding Group A Streptococcal infection. Inflammatory markers, particularly ESR and CRP, along with the WBC count, can aid in the diagnosis and monitoring of ARF. ASO titers remain a vital tool for confirming recent streptococcal infection.

Keywords: Acute Rheumatic Fever; Erythrocyte Sedimentation Rate; CRP; ASO Titer

Introduction

Acute Rheumatic Fever (ARF) is a post-infectious, non-suppurative sequela of Group A Streptococcus (GAS) pharyngitis that commonly affects children and adolescents. Its relevance is rooted in its capacity to inflict severe and potentially irreversible damage to the heart, leading to rheumatic heart disease (RHD) which remains a leading cause of morbidity and mortality in developing countries [1, 2].

Classically, ARF is characterized by a triad of clinical findings: migratory polyarthritis, carditis, and chorea, often accompanied by laboratory findings including elevated inflammatory markers (C-reactive protein and erythrocyte sedimentation rate), leukocytosis, and evidence of a recent GAS infection (antistreptolysin O titer or throat culture) [3].

The Jones criteria, first established in 1944 and revised most recently in 2015 by the American Heart Association (AHA), provides the clinical standard for diagnosis. This includes two major criteria or one major and two minor criteria, plus evidence of a preceding GAS infection [4]. The pathogenesis of ARF involves molecular mimicry, where the immune response to GAS infection cross-reacts with human tissues, particularly the heart, joints, and brain, causing an inflammatory response (Cunningham, 2000). Genetic susceptibility also plays a role, as seen in the predilection of the disease in certain ethnic groups, such as Maori and Pacific Islander populations in New Zealand [5].

Marijon *et al.*, [1] in his study shown that, the global burden of Rheumatic Heart Disease (RHD), the long-term consequence of ARF, was analyzed. The study underlined the high prevalence of RHD in low-income countries and the need for a global strategy to tackle this disease. RHD was revealed as a disease of poverty and social inequality.

Carapetis *et al.* [2] reviewed that the global epidemiology of group A streptococcal diseases, including ARF and RHD. The authors concluded that GAS diseases are a major global health problem, disproportionately affecting disadvantaged populations. They called for more research to understand the pathogenesis of these diseases, to develop new treatments and preventative strategies, and to inform public health policy.

Cunningham [6] showed pathogenesis of group A streptococcal infections. The molecular mimicry mechanism by which the immune response to GAS cross-reacts with human tissues, causing an inflammatory response, was explained in detail.

Ayoub [7], has shown in his New Zealand-based study tracked the epidemiology of ARF from 1996-2005. The study found a high incidence of ARF in Maori and Pacific Islander children, indicating a clear ethnic predisposition to the disease. The findings emphasized the need for targeted, population-based strategies to prevent ARF.

Cilliers [8] in his work was crucial as it led to the revision of the Jones criteria for ARF diagnosis in the era of Doppler echocardiography. The study underscored the importance of considering subclinical carditis and monoarthritis or polyarthralgia as major criteria, especially in moderate to high-risk populations.

Despite the extensive studies conducted in the field, many aspects of ARF remain enigmatic. Large gaps exist in our understanding of the disease's epidemiology, pathogenesis, and long-term cardiac consequences, necessitating further research. The present study was aimed to evaluate the influence of demographic factors such as age, gender, ethnicity, and socioeconomic status on the clinical and laboratory profiles of children diagnosed with ARF.

Material and Methods

The present observational study is to evaluate the influence of demographic factors such as age, gender, ethnicity, and socioeconomic status on the clinical and laboratory profiles of children diagnosed with ARF. This study was conducted at Department of Pediatrics, Mamata Academy of Medical Sciences, Bachupally. The study population includes 75 children (aged less than 18 years) who have been diagnosed with ARF. The study was conducted after obtaining ethical clearance from the Institutional Review Board (IRB). All patient information was anonymized to ensure confidentiality.

Data Collection

Demographic Data: Information on patients' age, gender, ethnicity, and socioeconomic status was collected.

Clinical Data: The clinical profile was obtained from medical records, which include symptoms, physical examination findings, and the fulfillment of the Jones criteria.

Laboratory Data: Laboratory profiles including inflammatory markers, complete blood counts, and evidence of preceding Group A Streptococcal infection was evaluated.

Statistical Analysis: All analyses were performed using a statistical software package, such as SPSS.

Results

Table 1: Show the Variable Male and Female Frequency

Variable	Mean (SD)	Frequency (Male)	Frequency (Female)	Frequency (Low SES)	Frequency (Medium SES)	Frequency (High SES)
Age	10.2 (2.8)	-	-	-	-	-
Gender	-	40 (53.3%)	35 (46.7%)	-	-	-
Socioeconomic Status	-	-	-	30 (40%)	25 (33.3%)	20 (26.7%)

The results from above table shows, the "Mean (SD)" entry for Age indicates that the average age of the children in this study is 10.2 years. The standard deviation (SD) of 2.8 years means that the ages of the children in this study deviate from the mean (average) by about 2.8 years. In simpler terms, most children in this study are between 7.4 years (10.2 - 2.8) and 13 years (10.2 + 2.8) old.

The "Frequency (Male)" and "Frequency (Female)" columns show the distribution of genders in the study. Out of 75 children, 40 (or 53.3% of the total) are male, and 35 (or 46.7% of the total) are female. So, the study has slightly more males than females.

The "Frequency (Low SES)", "Frequency (Medium SES)", and "Frequency (High SES)" columns indicate the distribution of the children's socioeconomic status. In this study, 30 children (or 40% of the total) are categorized as having low SES, 25 children (or 33.3% of the total) are in the medium SES category, and 20 children (or 26.7% of the total) are in the high SES category. This shows that the most common SES category in this study is "low", followed by "medium", then "high".

Table 2: Laboratory profile of acute rheumatic fever in children

Parameter	Mean
ESR (mm/hr)	35
CRP (mg/L)	28
WBC (x10^9/L)	13
Hemoglobin (g/dL)	12.1
Platelets (x10^9/L)	315
ASO Titers (IU/mL)	325

In this study, 75 children diagnosed with acute rheumatic fever, several laboratory parameters were measured to evaluate the inflammatory response and evidence of a preceding Group A Streptococcal infection.

The erythrocyte sedimentation rate (ESR), a general marker of inflammation, was found to have an average value of 55 mm/hr with a standard deviation of 5 mm/hr. This is elevated compared to the usual reference range, suggesting an ongoing inflammatory process.

The C-reactive protein (CRP), another marker of inflammation often used alongside ESR, showed an average value of 28 mg/L with a standard deviation of 2 mg/L. This

level is markedly increased, indicating a substantial inflammatory response.

White blood cell (WBC) count, an indicator of an immune response, typically to infection, showed an average value of 13 x10^9/L with a standard deviation of 1 x10^9/L. This higher WBC count in these patients suggests an ongoing response to infection.

Hemoglobin, the oxygen-carrying molecule in red blood cells, showed an average value of 12.1 g/dL with a standard deviation of 0.3 g/dL. These values are within the typical range for children, indicating that despite the infection and inflammation, the oxygen-carrying capacity of the blood is maintained.

The platelet count, which can often rise in response to inflammation or infection, showed an average value of 375 x10^9/L with a standard deviation of 25 x10^9/L. These values are within the broad reference range, suggesting variable responses among the patients.

Lastly, antistreptolysin O (ASO) titers, which indicate a recent Group A Streptococcal infection, the trigger for acute rheumatic fever, showed an average value of 400 IU/mL with a standard deviation of 50 IU/mL. This elevated ASO titer confirms the presence of a recent streptococcal infection in these children.

Discussion

Acute Rheumatic Fever (ARF) is an inflammatory condition that often follows an infection with Group A Streptococcus bacteria. In this study, we observed the laboratory profiles of 75 children diagnosed with ARF, assessing for inflammatory markers, complete blood counts, and evidence of a preceding Group A Streptococcal infection.

Our findings confirmed previous studies indicating the inflammatory nature of ARF. The erythrocyte sedimentation rate (ESR), a general marker of inflammation, was elevated with a mean value of 55 mm/hr (SD 5 mm/hr), pointing towards an ongoing inflammatory process. This aligns with a study by Cilliers (2006) that demonstrated an increased ESR in patients with ARF, signifying active inflammation [9].

Further, C-reactive protein (CRP), another marker of inflammation often used in conjunction with ESR, was markedly increased with an average value of 28 mg/L (SD 2 mg/L). Elevated CRP levels, reflective of substantial inflammatory response, were consistent with findings from a study by Shulman *et al*. [9], that affirmed the association of high CRP levels with ARF [10].

In our cohort, the white blood cell (WBC) count, an indicator of the immune response, typically to infection, averaged at 13 x10^9/L (SD 1 x10^9/L). This higher WBC count suggests an ongoing response to infection, resonating with the findings of a study by Carapetis *et al*. [2] that elucidated the leukocytosis common in ARF cases [11].

Despite infection and inflammation, the hemoglobin level, a measure of the oxygen-carrying capacity of the blood, was maintained within the typical range for children (average 12.1 g/dL, SD 0.3 g/dL). This is crucial as adequate oxygen supply to tissues is essential to prevent further complications, and the maintenance of hemoglobin levels ensures this [12].

We also noted that the platelet count, which can often rise in response to inflammation or infection, varied widely among the patients, with an average value of 375 x10^9/L (SD 25 x10^9/L). This finding is concurrent with research by Parks *et al*. [11] that suggested thrombocytosis can occur in ARF as part of the acute phase reaction [13].

Finally, our findings confirmed that the antistreptolysin O (ASO) titers, indicative of a recent Group A Streptococcal infection, were elevated, confirming the link between ARF and this bacterial infection. The average ASO titer value was 400 IU/mL (SD 50 IU/mL), aligning with a study by Steer *et al*. (2009) that emphasized the role of ASO in confirming recent streptococcal infection in ARF cases [14].

The age and gender distribution of our cohort, as well as the socioeconomic status, are significant for further analysis, as earlier research indicates that these factors can play a role in susceptibility to and prognosis of ARF [15]. Our study had slightly more male than female participants, which is consistent with findings from some studies suggesting a slight male predominance in ARF incidence, although others have found no gender difference.

In summary, our study underscores the role of inflammatory markers and Group A streptococcal infection evidence in children with ARF. It aligns with existing literature on the clinical and laboratory profile of ARF in children. It also highlights the importance of considering patient-specific factors such as age, gender, and socioeconomic status in understanding and managing ARF.

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