Original Article

Inflammatory Markers in Rheumatoid Patients and Cardiac Function: Insights from an Iranian University Hospital

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Abstract

Background: Rheumatoid arthritis (RA) is a chronic autoimmune disorder associated with increased cardiovascular morbidity and mortality. This study investigated the association between RA inflammatory markers, such as erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and various cardiac function parameters.

Materials and Methods: A cross-sectional study involved 71 patients diagnosed with RA at Imam Hossein Hospital in Tehran, Iran. Cardiac function parameters, including left ventricular end-diastolic diameter (LVDD), left ventricular end-systolic diameter (LVDS), left ventricular ejection fraction (EF), E/A ratio, septal e' velocity, left atrial (LA) area, and LA size, were assessed using echocardiography. The correlation between RA inflammatory markers and cardiac function parameters was analyzed using Pearson correlation coefficients. Multiple linear regression models were employed to further explore these associations. Statistical analyses were performed using SPSS Statistics version 26.

Results: Among the cardiac function parameters assessed, only LA size significantly correlated with RA inflammatory markers (ESR-CRP) ($p = 0.034$). However, LVDD, LVDS, EF, and E/A ratios did not exhibit significant correlations. Septal e' velocity notably showed a weak positive correlation with inflammatory markers.

Conclusion: Our findings suggest a potential link between systemic inflammation in RA and cardiac remodeling, particularly affecting LA size. This highlights the importance of monitoring cardiac function parameters, especially LA size, in RA patients to identify individuals at higher risk of cardiovascular complications. Further research is warranted to elucidate this association's underlying mechanisms and clinical implications.

Keywords: Legg-Calve-Perthes Disease, Orthopedics, Pediatrics, Pamidronate

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Introduction

Rheumatoid arthritis (RA) is a chronic autoimmune disorder characterized by joint inflammation, which can lead to progressive joint damage and disability if left untreated[1-3]. Beyond its primary effects on the joints, RA has been associated with an increased risk of

cardiovascular diseases (CVD), including heart failure, coronary artery disease, and atrial fibrillation[4-7]. Inflammatory markers, such as C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), are commonly elevated in RA and are believed to contribute to the heightened cardiovascular risk observed in these patients[8-13].

Despite advancements in understanding the link between RA and CVD, the precise mechanisms underlying this association remain incompletely elucidated [4]. ESR and CRP, as markers of systemic inflammation, have been proposed as potential mediators of cardiovascular dysfunction in RA. Understanding the relationship between RA inflammatory markers and cardiac function parameters could provide valuable insights into the pathophysiology of CVD in RA patients.

Therefore, this study aims to investigate the association between RA inflammatory markers, specifically ESR and CRP, and various cardiac function parameters, including left ventricular dimensions, ejection fraction (EF), E/A ratio, septal e' velocity, and left atrial (LA) size.

Methods

Study Design and Participants: This year-long observational study, conducted at Imam Hossein Hospital in Tehran, Iran, focused on individuals diagnosed with RA, following the American College of Rheumatology criteria. The study included adults aged 18 and older without a history or signs of heart disease. Evaluation of cardiac function parameters, such as left ventricular end-diastolic diameter (LVDD), left ventricular end-systolic diameter (LVDS), left ventricular EF, E/A ratio, septal e' velocity, LA area, and LA size, was conducted using echocardiography. Inflammatory markers (ESR-CRP) were analyzed using appropriate laboratory tests. Ethical approval for this study was granted by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran (IR.SBMU.RETECH.REC.1402.700).

Data Collection: Patient data collection involved meticulous evaluation of cardiac parameters, namely, LVDD, LVDS, EF, E/A ratio, septal e' velocity, LA area, and LA size. This encompassed a comprehensive assessment of demographics, clinical background, and paraclinical indicators. The questionnaire incorporated essential variables such as age, gender, severity of rheumatoid arthritis, and echocardiographic results.

Statistical Analysis: Descriptive statistics were employed to summarize cardiac function parameters and inflammatory markers (ESR-CRP), followed by correlation analysis to explore their associations. Additionally, multiple linear regression models were constructed to investigate the influence of inflammatory markers on cardiac function parameters. The significance of coefficients (B) in the regression models was assessed using the t-test, with p-values indicating the strength of associations. All statistical analyses were conducted using IBM SPSS Statistics version 26.

Results

In the study cohort comprising 71 patients, demographic characteristics and RA inflammatory markers were assessed. The mean age of participants was 52.31 years, with females representing 91.5% of the sample. Analysis of RA inflammatory markers (ESR-CRP) revealed that 7.7% of participants had high levels, while 18.5% presented with low levels (Table 1).

Cardiac function parameters: Table 2 provides a comprehensive overview of the cardiac function parameters measured in the study cohort. Notably, the LVDD exhibited a mean value of 5.73 mm, indicating the size of the heart at the end of diastole, with a standard deviation of 7.16 mm. In comparison, the LVDS displayed a mean of 3.52 mm, representing the heart's size at the end of systole, with a standard

Table 1. Summary of Demographic and Rheumatoid Arthritis Inflammatory Markers**.**

Variable	Frequency	Percent
Age		
Mean	52.31	-
Std. Deviation	11.861	-
Gender		
Male	6	8.5
Female	65	91.5
RA inflammatory markers (ESR-CRP)		
High	21	7.7
Low	50	18.5

deviation of 3.62 mm. The mean EF, a critical indicator of heart health, was recorded at 53.10%, with a standard deviation of 3.52%. Additionally, parameters such as the E/A ratio and septal e' velocity provide insights into diastolic function, with mean values of 0.66 and 7.52 cm/s, respectively. Notably, the LA area, a marker of left atrial remodeling, had a mean area of 17.25 cm². Remarkably, most participants (81.7%) exhibited a normal left atrial size, while a smaller proportion (18.3%) showed mild enlargement.

Correlation between Cardiac Parameters and RA Inflammatory Markers: Table 3 summarizes the correlation between cardiac function parameters and inflammatory markers (ESR-CRP). Notably, LVDD exhibited a negative correlation of -0.104 with ESR-CRP, albeit not statistically significant (p = 0.393). Similarly, LVDS displayed a weak negative correlation of -0.100 with ESR-CRP (p = 0.411). Conversely, the EF showed a positive correlation of 0.088 with ESR-CRP, although insignificant (p = 0.467). Other parameters such as the E/A ratio, septal e' velocity, and LA area also demonstrated correlations with ESR-CRP, but none reached statistical significance. Notably, a significant positive correlation was observed between LA size and ESR-CRP (r = 0.252, p = 0.034), suggesting a potential association between RA inflammatory markers and left atrial size.

Table 2. Summary of Cardiac Function Parameters**.**

Cardiac function parameters	Mean	Std. Deviation
LVDS	3.52	3.62
LVDD	5.73	7.16
EF	53.10	3.52
E/A Ratio	0.66	0.16
Septal e' velocity	7.52	1.54
LA area	17.25	3.14
LA size	**Frequency**	**Percent**
Normal	58	81.7%
Mild	13	18.3%

Table 3. Correlation between Cardiac Function Parameters and RA Inflammatory Markers**.**

Cardiac Function Parameters	Pearson Correlation	p-value
LVDS	-0.100	0.411
LVDD	-0.104	0.393
EF	0.088	0.467
E/A Ratio	0.084	0.489
Septal e' Velocity	0.062	0.608
LA Area	0.137	0.258
LA Size	0.252	0.034

Table 4. Multiple Linear Regression of Cardiac Function Parameters on RA Inflammatory Markers**.**

Dependent Variable	Coefficient (B)	p-value
LVDS	-0.784	0.411
LVDD	-1.610	0.393
EF	0.671	0.467
E/A Ratio	0.029	0.489
Septal e' velocity	0.207	0.608
LA area	0.933	0.258
LA size	0.213	0.034

Regression analysis: Table 4 summarizes the results of multiple linear regression analysis, assessing the relationship between cardiac function parameters and inflammatory markers (ESR-CRP). The coefficients represent the change in the dependent variable (cardiac function parameter) for a unit change in the independent variable (ESR-CRP). Notably, for LVDD, LVDS, and EF, the coefficients (-1.610, -0.784, and 0.671, respectively) were not statistically significant (p > 0.05), indicating no significant association with ESR-CRP. Conversely, LA size demonstrated a statistically significant positive association with ESR-CRP (B = 0.213, p = 0.034), suggesting that higher levels of inflammatory markers are associated with increased LA size. The coefficients for the E/A ratio, septal e' velocity, and LA area were not statistically significant, indicating no significant linear relationship with ESR-CRP.

Discussion

Principle finding: Our study uncovered a noteworthy relationship between RA inflammatory markers, ESR CRP, and cardiac function parameters. Elevated levels of these markers correlated with adverse changes in LA size. However, LVDD, LVDS, EF and E/A ratio showed no significant correlation. Septal e' velocity notably exhibited a weak positive correlation with inflammatory markers. These findings suggest systemic inflammation may impact cardiac function in RA patients, emphasizing the need for monitoring inflammatory markers to assess cardiovascular risk.

Clinical implications: The observed associations

between RA inflammatory markers and cardiac function parameters underscore the importance of comprehensive cardiovascular assessment in RA patients [14-17]. Monitoring levels of inflammatory markers, particularly ESR and CRP, may serve as valuable indicators of cardiovascular risk in this population [18]. Clinicians should consider regular evaluation of cardiac function parameters, such as left ventricular dimensions and atrial size, alongside inflammatory marker measurements to identify individuals at heightened risk for cardiovascular complications. Early detection and management of inflammation-driven cardiac dysfunction could mitigate the risk of adverse cardiovascular outcomes in RA patients[19-21].

Limitations: While our study sheds light on the association between RA inflammatory markers and cardiac function parameters, some factors should be considered when interpreting the findings. Firstly, the study's observational design precludes establishing causality between RA inflammatory markers and cardiac function parameters. Secondly, the sample size, although sufficient for our analysis, may not fully represent the diversity within the RA population, potentially limiting the generalizability of our results. Lastly, relying solely on echocardiography for cardiac function assessment may overlook other contributors to cardiovascular risk in RA patients.

Conclusion

The analysis revealed that only LA size exhibited a statistically significant association with RA inflammatory markers among the various cardiac function parameters investigated. This finding suggests a potential influence of systemic inflammation on cardiac remodeling, particularly affecting LA size in individuals with RA. Further exploration into the underlying mechanisms and longitudinal studies are warranted to elucidate the clinical implications of this association for cardiovascular risk assessment and management in RA patients.

Acknowledgment

None.

Conflict of interest

The authors further declare that they have no conflict of interest.

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