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ORIGINAL RESEARCH OPEN ACCESS

A cross-sectional study of diastolic dysfunction in newly diagnosed rheumatoid arthritis patients and its correlation with disease activity in eastern India

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Abstract

Background: Rheumatoid arthritis (RA) is a systemic autoimmune disease with increased cardiovascular morbidity and mortality. Left ventricular (LV) diastolic dysfunction may occur early, even in the absence of overt cardiac disease. The aim of this study was to determine the prevalence of left ventricular diastolic dysfunction in newly diagnosed rheumatoid arthritis patients and to assess its correlation with disease activity and disease duration.

Methods: A cross-sectional case–control study was conducted on 50 newly diagnosed RA patients (2010 ACR/EULAR criteria) and 50 age- and sex-matched healthy controls at R.G. Kar Medical College, Kolkata. Patients with conventional cardiac risk factors were excluded. Disease activity was assessed by DAS28. Laboratory markers (ESR, CRP, RF, ACPA) and echocardiographic parameters of diastolic dysfunction (E wave, A wave, E/A ratio, DT, IVRT, LA volume, E′, E/E′) were measured.

Results: Mean patient age was 36.8 years; 80% were female. RF was positive in 92%, ACPA in 46%, and CRP in 72%. Diastolic dysfunction was found in 30% of RA patients versus 12% of controls ($p<0.05$). RA patients had significantly reduced E wave (0.80 vs. 0.95 m/s, $p=0.003$) and E/A ratio (1.26 vs. 1.44, $p=0.004$). DAS28 correlated negatively with E wave ($r=-0.572$, $p<0.001$) and E/A ratio ($r=-0.696$, $p<0.001$), and positively with DT ($r=0.291$, $p=0.04$), IVRT ($r=0.332$, $p=0.019$), and LVESD ($r=0.306$, $p=0.031$). Disease duration correlated negatively with E wave ($r=-0.433$, $p=0.002$).

Conclusion: Subclinical diastolic dysfunction is frequent in newly diagnosed RA and correlates with disease activity, suggesting the need for early echocardiographic screening in this population.

Keywords: rheumatoid arthritis; diastolic dysfunction; DAS28; echocardiography; Eastern India

Introduction

Rheumatoid arthritis (RA) is a chronic systemic autoimmune disease characterized by persistent synovitis, joint damage, and extra-articular involvement. It affects about 0.5–1% of the population worldwide, with a female predominance and peak onset in the fourth and fifth decades of life [1]. Beyond musculoskeletal manifestations, RA is associated with increased cardiovascular morbidity and mortality, largely attributable to accelerated atherosclerosis and myocardial dysfunction [2].

Mortality in RA is 1.5–1.6 times higher than in the general population, with cardiovascular disease being the leading cause [3]. Left ventricular diastolic dysfunction, even in the presence of preserved ejection fraction, has been documented in RA patients without overt heart

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disease, reflecting subclinical myocardial involvement [4]. Such dysfunction contributes to adverse outcomes, including heart failure with preserved ejection fraction and sudden cardiac death [5].

The pathophysiology involves chronic systemic inflammation, cytokine-mediated myocardial remodelling, and microvascular dysfunction.[6] Traditional risk factors alone do not explain the heightened cardiovascular risk in RA, emphasizing disease-specific mechanisms.[7] Previous studies in Western populations have linked disease duration and activity with diastolic abnormalities,[8] but Indian data, especially from newly diagnosed RA patients, are sparse.

This study was undertaken to assess diastolic dysfunction in newly diagnosed RA patients in Eastern India and its correlation with disease activity and disease duration.

Materials and methods

This was a cross-sectional case–control study conducted at the Rheumatology Clinic, R.G. Kar Medical College and Hospital, Kolkata, over one year from March 2023 to February 2024. Institutional ethics approval was obtained, and informed consent was taken.

The study included 50 newly diagnosed rheumatoid arthritis (RA) patients aged 16–65 years, all fulfilling the 2010 ACR/EULAR classification criteria. An equal number of age- and sex-matched healthy volunteers (n=50) were recruited as controls. Patients with diabetes, hypertension, ischemic heart disease, smoking history, pregnancy, or any other comorbid cardiac conditions were excluded from the study.

Disease activity in rheumatoid arthritis patients was assessed using the DAS28 score, which incorporates tender and swollen joint counts, erythrocyte sedimentation rate (ESR), and the patient's global assessment. Laboratory investigations included hemoglobin estimation, ESR, C-reactive protein (CRP), rheumatoid factor (RF) detected by latex agglutination test (values >20 IU/ml considered positive), and anti-cyclic citrullinated peptide antibody (ACPA) measured by enzyme-linked immunosorbent assay (ELISA), with values >15 U/ml regarded as positive

All participants underwent standard transthoracic echocardiography (2D, M-mode, Doppler). Parameters included were-LV dimensions, EF, LA volume,Mitral inflow: E wave, A wave, E/A ratio, deceleration time (DT), isovolumetric relaxation time (IVRT), Tissue Doppler: E□, E/E□,Diastolic dysfunction was graded according to ASE/EACVI guidelines.

Statistical analysis

Data were analyzed using SPSS v20. Results expressed as mean ± SD or proportions. Correlation between DAS28, disease duration, and echocardiographic parameters was tested using Pearson's coefficient. Significance was set at $p<0.05$.

Results

The mean age of the study population was 36.8 ± 8.1 years, with a clear female predominance (80%). The majority of patients (48%) belonged to the 30–39 years age group (Figure 1).

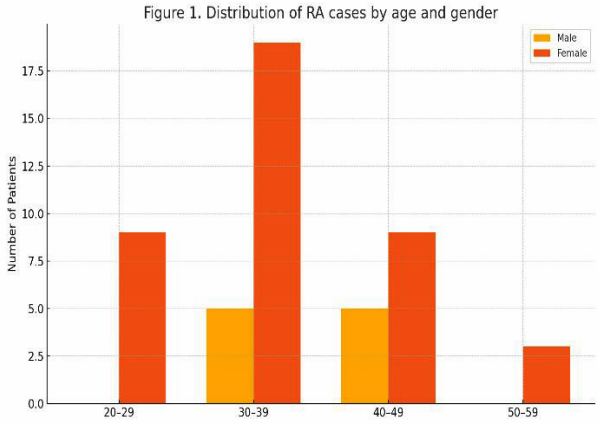

Figure 1: Age and gender distribution of the study participants.

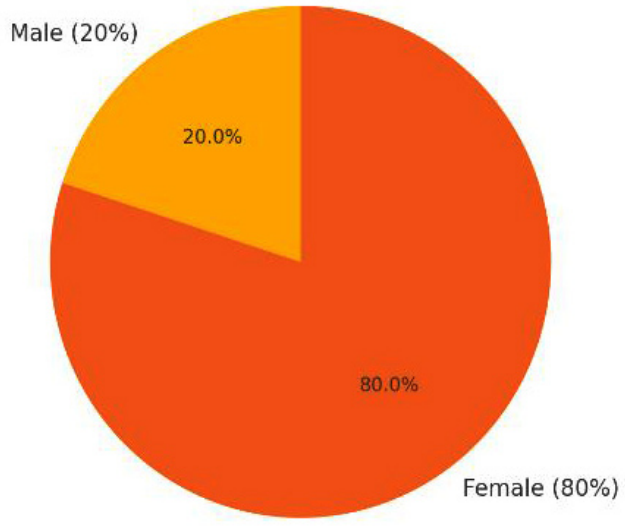

Figure 2: Sex distribution of the study participants.

Rheumatoid factor (RF) was positive in 92% of the patients, while anti-cyclic citrullinated peptide antibody (ACPA) was detected in 46%. Elevated C-reactive protein (CRP) levels were observed in 72% of cases. Erythrocyte sedimentation rate (ESR) showed a significant positive correlation with disease activity as measured by DAS28 ($r=0.567$, $p<0.001$) (Figures 3-5).

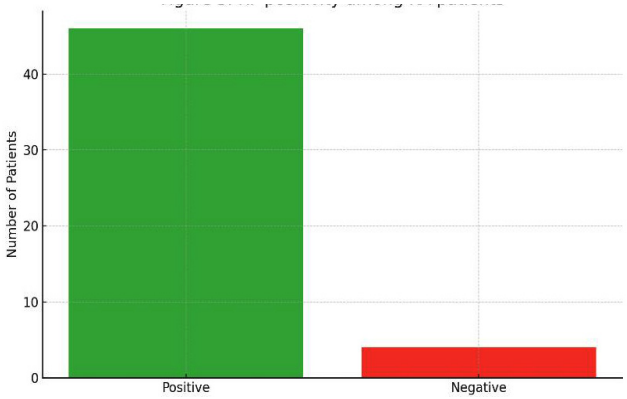

Figure 3: Rheumatoid factor (RF) positivity.

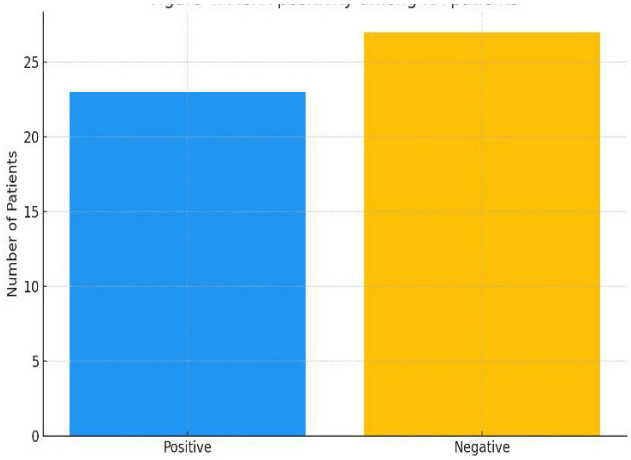

Figure 4: Anti-cyclic citrullinated peptide (ACPA) positivity.

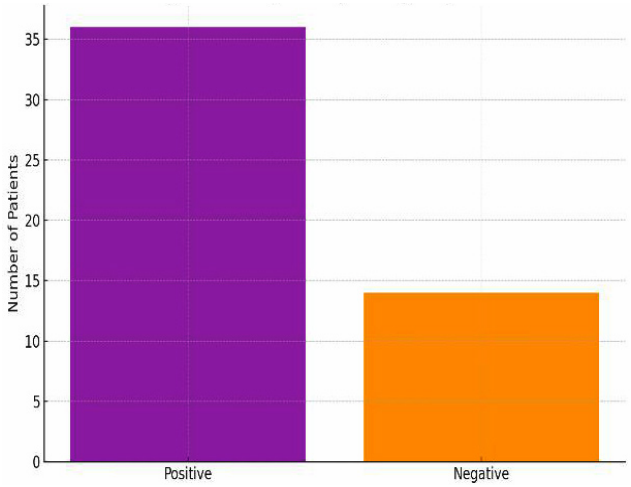

Figure 5: C-reactive protein (CRP) positivity.

Diastolic dysfunction was identified in 30% of RA patients compared to 12% in the control group, and this difference was statistically significant ($p<0.05$). Compared to controls, RA patients demonstrated a significantly reduced E wave velocity (0.80±0.20 vs. 0.95±0.21 m/s, $p=0.003$) and a lower E/A ratio (1.26±0.32 vs. 1.44±0.31, $p=0.004$). However, no significant difference was noted between the two groups with respect to left ventricular ejection fraction (EF) or left ventricular end-diastolic dimension (LVEDD) (Figure 6).

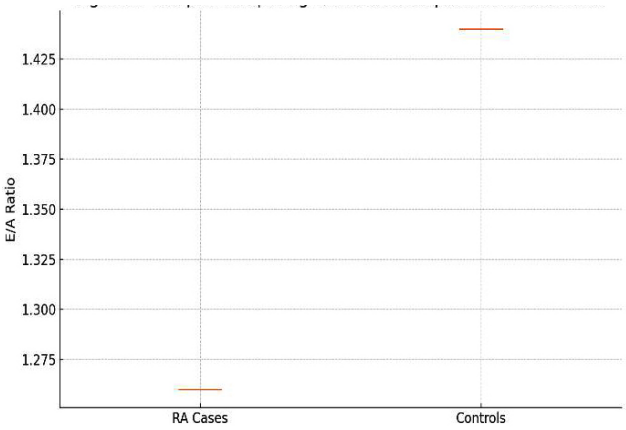

Figure 6: Box plot showing the E/A ratio in cases and controls.

A significant negative correlation was observed between disease activity, as measured by the DAS28 score, and left ventricular diastolic function, represented by the E/A ratio. Higher DAS28 scores were associated with lower E/A ratios, indicating that increased disease activity in newly diagnosed rheumatoid arthritis patients is linked to impaired diastolic function ($r = -0.696$, $p < 0.001$) (Figure 7).

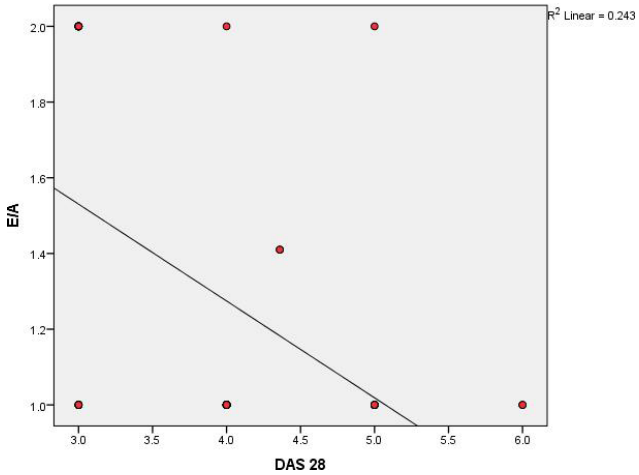

Figure 7: Scatter diagram showing the correlation between DAS28 score and E/A ratio.

Correlation with disease activity

On correlation analysis, DAS28 showed a statistically significant negative correlation with E wave ($r=-0.572$, $p<0.001$) and E/A ratio ($r=-0.696$, $p<0.001$), indicating worsening diastolic function with increasing disease activity. In contrast, DAS28 demonstrated a significant positive correlation with deceleration time (DT) ($r=0.291$, $p=0.04$), isovolumetric relaxation time (IVRT) ($r=0.332$, $p=0.019$), and left ventricular end-systolic dimension (LVESD) ($r=0.306$, $p=0.031$) (Figure 7).

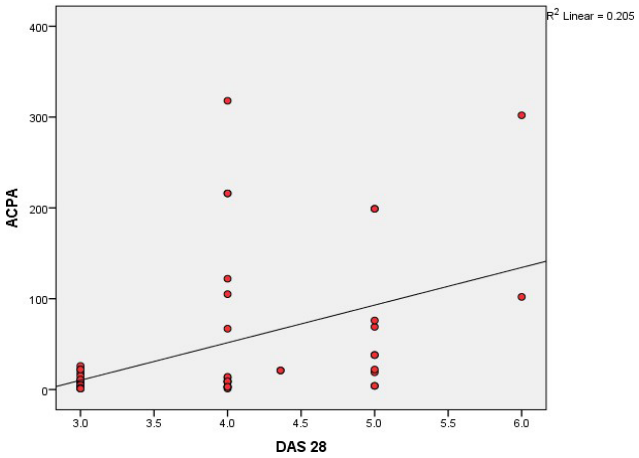

Figure 8: Showing correlation between DAS 28 and ACPA and ACPA titre increase with increase in DAS28 scores,suggested by the positive correlation coefficient (r=0.386) and highly significant P-value (P=0.006).

Correlation with disease duration

Disease duration was found to have a significant negative correlation with E wave velocity (r=−0.433, p=0.002), suggesting that longer disease duration was associated with impaired ventricular relaxation. No statistically significant correlation was observed between disease duration and E/A ratio or other echocardiographic parameters (Figure 9).

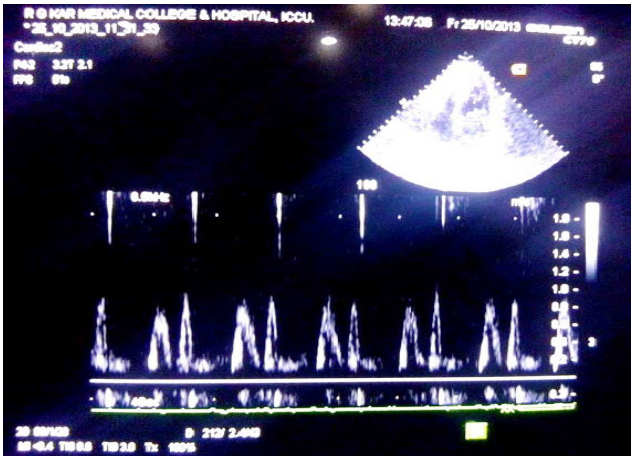

Figure 9: Echocardiography of RA patients of a case in our study showing diastolic dysfunction with decreased E/A ratio.

Discussion

Our study demonstrates that subclinical LV diastolic dysfunction is common in RA patients, even at diagnosis, and correlates strongly with disease activity. About 30% of patients had grade 1 diastolic dysfunction, compared to only 12% of healthy controls.

Previous studies in Europe and the Middle East also reported a higher prevalence of diastolic dysfunction in RA [4, 8]. Chronic systemic inflammation, mediated by cytokines such as TNF-α and IL-6, is believed to drive myocardial remodeling and fibrosis [6,9]. Importantly, we excluded patients with traditional cardiovascular risk factors, strengthening the link between RA-specific inflammation and cardiac involvement.

The negative correlation of DAS28 with E wave and E/A ratio, and positive correlation with DT and IVRT, indicate impaired ventricular relaxation associated with active disease. This aligns with findings from Di Franco et al. and Alpaslan et al., who observed similar diastolic abnormalities in RA patients without overt cardiac disease [8,10].

The association between disease duration and E wave further suggests progressive subclinical myocardial involvement. Early detection is crucial since diastolic dysfunction with preserved EF is an independent predictor of mortality in RA [5].

Limitations: Small, hospital-based sample; cross-sectional design limits causal inference; advanced biomarkers and pulmonary venous Doppler indices were not measured due to resource constraints. Despite limitations, our findings emphasize the importance of routine echocardiographic screening in RA, especially in high disease activity states, to enable timely interventions.

Conclusion

Subclinical LV diastolic dysfunction is prevalent in newly diagnosed RA patients in eastern India, correlating significantly with disease activity and duration. Echocardiography may be a valuable tool in the baseline evaluation of RA to identify early cardiac involvement. Integrating cardiovascular risk assessment into RA management could improve long-term outcomes.

Conflicts of interest

Authors declare no conflicts of interest.

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