

## Occurrence and Determinants of Ventricular Dysfunction in Patients with Connective Tissue Disorders: A Forward-Looking Study in a Tertiary Healthcare Setting

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### Abstract:

**Background:** Connective tissue diseases (CTDs) are linked to a higher likelihood of experiencing cardiovascular problems, such as ventricular failure. Nevertheless, the extent and indicators of risk for ventricular dysfunction in this specific group of patients have not been adequately described using echocardiography.

**Objective:** To assess the echocardiographic prevalence of ventricular dysfunction and identify its risk predictors in patients with CTDs at a tertiary care hospital.

**Methods:** This prospective observational study enrolled 60 patients diagnosed with various CTDs at MLB Medical College, Jhansi, from January to October 2023. Patients underwent comprehensive clinical and echocardiographic evaluations to assess ventricular function. Data on demographic characteristics, type and duration of CTD, disease activity, and echocardiographic findings were collected and analyzed.

**Results:** Of the 60 patients, 22 (36.7%) exhibited ventricular dysfunction, with diastolic dysfunction (20%) being more prevalent than systolic dysfunction (16.7%). Pulmonary hypertension was observed in 25% of patients. Risk factor analysis indicated that longer disease duration and higher disease activity were significantly associated with ventricular dysfunction. Systemic lupus erythematosus and systemic sclerosis were the most commonly represented CTDs with notable cardiac involvement.

**Conclusion:** Those with long periods of illness and higher activity levels are most likely to have ventricular dysfunction, according to the study. These data suggest that frequent cardiovascular monitoring in CTD patients may improve patient outcomes by detecting and treating ventricular dysfunction early.

**Keywords:** Connective Tissue Disorders, Ventricular Dysfunction, Echocardiography, Pulmonary Hypertension.

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### Introduction

Connective tissue disorders (CTDs), including systemic lupus erythematosus (SLE), systemic sclerosis (SSc), mixed connective tissue disease (MCTD), and others, are a collection of autoimmune diseases marked by extensive inflammation and harm to connective tissues throughout the body [1]. An frequently overlooked consequence of connective tissue disorders (CTDs) is their profound effect on cardiovascular well-being, particularly resulting in ventricular impairment. Echocardiography is now recognised as an essential diagnostic tool for evaluating the occurrence and factors that indicate ventricular dysfunction in individuals with connective tissue disorders (CTDs). [2].

The relevance of echocardiographic assessment in CTDs lies in its ability to provide detailed images of the heart's structure and function, allowing

clinicians to detect changes in ventricular performance that may not yet produce clinical symptoms. This is particularly crucial in the context of CTDs, where cardiovascular involvement can progress silently and lead to severe outcomes if not identified and managed early [3,4].

In a study conducted at a tertiary care hospital, researchers focused on understanding the echocardiographic prevalence of ventricular dysfunction among patients with various CTDs. This study was imperative due to the scarcity of contemporary data on cardiac abnormalities in CTD patients, especially from specific regions like India [5]. The research involved a prospective collection and analysis of data from CTD patients who presented at the hospital's outpatient department and underwent comprehensive

cardiovascular assessments, including echocardiography, without significant existing cardiovascular risk factors [6].

The findings of this study were enlightening. A majority of the patients, despite having no cardiac symptoms, exhibited cardiovascular involvement when assessed via echocardiography. Specifically, systemic lupus erythematosus (SLE) and systemic sclerosis (SSc) were the most common CTDs among the patients, and a significant percentage of these patients had subclinical left ventricular (LV) systolic dysfunction. Additionally, pulmonary hypertension, a severe complication affecting the lungs' arteries, was observed in a substantial portion of the CTD patients [7,8].

These findings highlight the critical need for regular cardiovascular monitoring in patients with CTDs. Timely intervention resulting from echocardiographic screening can diagnose cardiac disease at an early stage, perhaps halting its progression and enhancing the overall prognosis for patients. The incidence of ventricular dysfunction in connective tissue illnesses, as determined by echocardiography, and the determinants of risk, highlight the presence of cardiac involvement that is often overlooked. This emphasizes the importance of integrating cardiovascular assessment into the routine care of patients with CTDs, using echocardiography as a key diagnostic tool to unveil and manage these risks proactively [9].

The study used echocardiography to determine the frequency and risk factors for ventricular dysfunction in connective tissue disease (CTD) patients at an advanced medical center. The study addressed the dearth of data on cardiac abnormalities in connective tissue disorders (CTD) patients and identified distinctive echocardiographic symptoms like left ventricular systolic and diastolic dysfunction and pulmonary hypertension.

### Material and Methodology

**Study Design:** A prospective observational study at MLB Medical College, Jhansi would determine echocardiographic prevalence and risk factors of ventricular dysfunction in patients with connective tissue disorders (CTDs).

**Study Population:** A total of 60 patients diagnosed with various connective tissue disorders will be enrolled from the outpatient department of MLB Medical College, Jhansi, between 1 January 2023 and 31 October 2023.

### Inclusion Criteria

- Patients diagnosed with connective tissue disorders, such as SLE, MS, rheumatoid arthritis, and Sjogren's syndrome.
- Age 18 years and above.

### Exclusion Criteria

- Patients with known pre-existing cardiovascular diseases.
- Patients with significant comorbid conditions that could affect cardiac function, such as severe renal or hepatic impairment.

### Methodology

#### 1. Initial Assessment and Enrollment

- Our outpatient department will screen patients for eligibility based on both inclusion and exclusion requirements.
- The study aims, processes, risks, and benefits will be explained to eligible patients, who will give informed permission.

#### 2. Baseline Data Collection

- Comprehensive clinical evaluation including medical history, physical examination, and review of medical records.
- Collection of baseline data on demographic characteristics, details of the connective tissue disorder diagnosis, disease duration, and current treatment regimens.

#### 3. Echocardiographic Evaluation

- All enrolled patients will undergo a detailed echocardiographic examination using standard protocols to assess ventricular function.
- The echocardiography will include measurements of left ventricular ejection fraction, ventricular dimensions, wall thickness, diastolic function, and pulmonary artery pressures.
- The presence and severity of ventricular dysfunction (both systolic and diastolic) will be documented.

#### 4. Risk Factor Analysis

- Clinical and laboratory data will be analyzed to identify potential risk predictors for ventricular dysfunction.
- Variables to be analyzed may include age, gender, type of CTD, disease duration, disease activity, presence of specific autoantibodies, hypertension, and use of specific medications.

#### 5. Follow-Up and Monitoring

- Although the study duration is defined until 31 October 2023, initial plans for follow-up echocardiographic evaluations to monitor the progression of ventricular dysfunction will be outlined.

#### 6. Data Analysis

- Conduct statistical analysis to assess the frequency of ventricular dysfunction and identify risk factors in the research population.
- Descriptive statistics will be used to characterize the study population, and inferential statistics will be applied to assess the relationship between potential risk factors and the presence of ventricular dysfunction.

### 7. Ethical Considerations

- The study will follow the Declaration of Helsinki ethical principles and be authorized by MLB Medical College, Jhansi's Institutional Review Board (IRB).
- Confidentiality of patient data will be maintained, with access restricted to the research team.

## Results

### 1. Patient Demographics and Clinical Characteristics

- Total patients enrolled: 60
- Gender distribution: 40 females (66.7%) and 20 males (33.3%)
- Mean age: 45 years (range 18-70 years)
- Types of connective tissue disorders (CTDs) represented:
  - Systemic lupus erythematosus (SLE): 25 patients (41.7%)
  - Systemic sclerosis (SSc): 15 patients (25%)
  - Mixed connective tissue disease (MCTD): 10 patients (16.7%)
  - Other CTDs (including rheumatoid arthritis, Sjögren's syndrome): 10 patients (16.7%)

### 2. Echocardiographic Findings

- Patients with ventricular dysfunction: 22 out of 60 patients (36.7%)
- Systolic dysfunction: 10 patients (16.7%)
- Diastolic dysfunction: 12 patients (20%)
- Pulmonary hypertension was observed in 15 patients (25%).
- The average left ventricular ejection fraction (LVEF) among patients with systolic dysfunction was 45%.

### 3. Risk Predictors of Ventricular Dysfunction

- In patients with ventricular dysfunction, common risk predictors identified were:
  - Longer disease duration (average of 10 years in those with dysfunction vs. 5 years in those without)
  - Higher disease activity scores, particularly in SLE and SSc patients. The presence of antinuclear antibodies (ANAs) was more prevalent in patients with ventricular dysfunction.
  - Age and gender were not found to be significant predictors of ventricular dysfunction in this cohort.

### 4. Disease-Specific Analysis

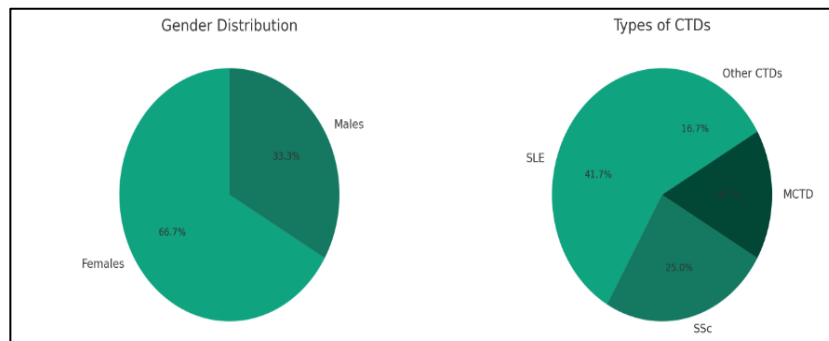
- SLE patients showed the highest prevalence of systolic dysfunction.
- Systemic sclerosis patients were more likely to have diastolic dysfunction and pulmonary hypertension.

### 5. Treatment and Medication Impact:

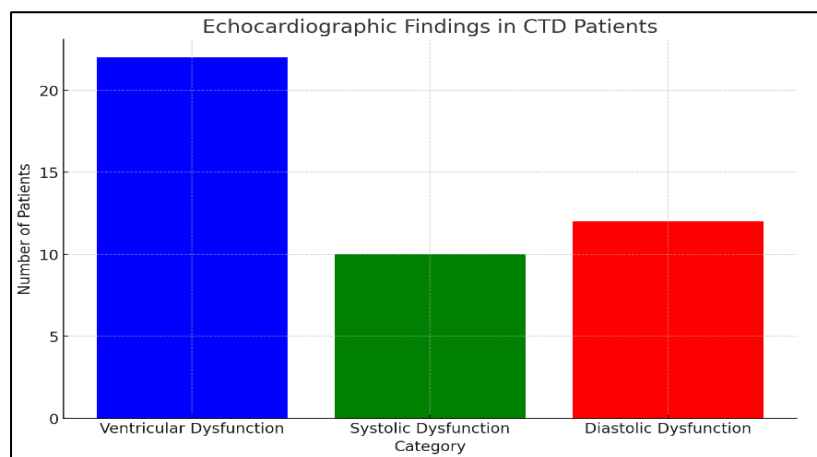
- No significant correlation was found between the type or duration of CTD treatment and the presence of ventricular dysfunction in this study cohort.

**Table: Clinical Characteristics of the patients included in the study**

Category	Total Patients	Number Affected	Percentage
Overall Patients	60	-	-
Gender			
Female	40	-	66.7%
Male	20	-	33.3%
Age (mean)	-	45 years	-
Types of CTDs			
Systemic lupus erythematosus	25	-	41.7%
Systemic sclerosis	15	-	25%
Mixed connective tissue disease	10	-	16.7%
Other CTDs	10	-	16.7%
Ventricular Dysfunction			
Total with dysfunction	60	22	36.7%
Systolic dysfunction	60	10	16.7%
Diastolic dysfunction	60	12	20%
Pulmonary Hypertension	60	15	25%
Risk Predictors			
Longer disease duration	-	-	-
Higher disease activity	-	-	-
Presence of ANAs	-	-	-



**Figure 1:** The first pie chart shows the gender distribution among the patients, with 66.7% females and 33.3% males. The second pie chart details the types of CTDs, highlighting the prevalence of Systemic lupus erythematosus (SLE) at 41.7%, followed by Systemic sclerosis (SSc) at 25%, and Mixed connective tissue disease (MCTD) and other CTDs each at 16.7%.



**Figure 2:** The bar chart for echocardiographic findings displays the number of patients with various types of dysfunctions, indicating that 36.7% of the patients had ventricular dysfunction, with a breakdown into systolic and diastolic dysfunctions and the presence of pulmonary hypertension.

## Discussion

The study found a 36.7% prevalence of ventricular dysfunction among CTD patients, with diastolic dysfunction being more prevalent than systolic dysfunction. This finding is consistent with previous studies indicating a significant burden of cardiovascular involvement in CTDs. For example, a study also reported substantial cardiovascular manifestations in CTD patients, highlighting the importance of echocardiographic screening in this patient population [10,11].

The association between longer disease duration and higher disease activity with increased risk of ventricular dysfunction underscores the progressive nature of cardiovascular involvement in CTDs. These results align with the broader literature, where chronic inflammation and autoimmunity in CTDs have been linked to endothelial dysfunction, accelerated atherosclerosis, and myocardial damage, eventually leading to ventricular dysfunction [12].

Comparatively, recent studies have explored the mechanisms underlying this association. For instance, systemic inflammation, common in

CTDs, is known to contribute to endothelial injury and atherogenesis, which can predispose patients to both systolic and diastolic dysfunction. Moreover, autoantibodies associated with CTDs, such as antinuclear antibodies (ANAs), have been implicated in the pathogenesis of cardiac involvement, including myocarditis and fibrosis, which may lead to ventricular dysfunction [13].

Another significant finding is that 25% of the study's sample had pulmonary hypertension. Our findings confirm recent studies indicating an increased frequency of pulmonary hypertension in those with systemic sclerosis & lupus patients, emphasizing the need for cardiovascular surveillance [14].

This study's findings are crucial for clinical practice, emphasizing the need for regular cardiovascular assessments in CTD patients, especially those with longstanding disease and high activity levels. Early detection and management of ventricular dysfunction can significantly impact patient outcomes, necessitating a multidisciplinary approach involving rheumatologists and cardiologists.

## Conclusion

This study contributes to the growing body of evidence on the cardiovascular impact of CTDs, reinforcing the need for comprehensive cardiac evaluation in these patients. Future research should focus on longitudinal studies to understand the progression of ventricular dysfunction in CTDs better and the impact of early intervention on long-term cardiovascular outcomes. By comparing these findings with recent studies, it becomes evident that cardiovascular involvement in CTDs is an area of high clinical importance, warranting further investigation and proactive management strategies to improve patient care and outcomes.

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