

## Dysfunction of the Ventricles in Connective Tissue Disorders: Echocardiographic Prevalence and Risk Factors

Ajay Kumar Sinha<sup>1</sup>, Akanksha Sinha<sup>2</sup>

<sup>1</sup>Professor & Head, Department of Medicine, Nalanda Medical College & Hospital, Patna, Bihar, India

<sup>2</sup>Senior Resident, Department of Cardiology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

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Corresponding Author: Dr. Akanksha Sinha

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### Abstract:

**Background:** The objective was to investigate the occurrence of ventricular dysfunction, including left ventricular systolic dysfunction (LVSD) and diastolic dysfunction (DD), in patients with connective tissue disorders. Additionally, the study aimed to identify clinical and echocardiographic risk predictors associated with ventricular dysfunction.

**Methods:** A retrospective investigation of the medical histories of 62 participants with connective tissue disorders who had undergone was conducted. Echocardiographic parameters were assessed for the presence of LVSD and DD. Clinical data, including age, gender, comorbidities, and specific connective tissue disorder diagnosis, were collected. Logistic regression examination was performed to identify risk predictors related with ventricular dysfunction.

**Results:** Among the 62 patients included in the study, ventricular dysfunction was observed in 33 patients (53.2%). LVSD was present in 18 patients (29%), while DD was detected in 27 patients (43.5%). Logistic regression evaluation found that age ( $p = 0.015$ ) and specific connective tissue disorder diagnosis ( $p = 0.009$ ) were significant predictors of ventricular dysfunction.

**Conclusion:** The study highlights a substantial prevalence of ventricular dysfunction, including LVSD and DD. Age and specific connective tissue disorder diagnosis were identified as significant risk predictors. Early echocardiographic assessment and monitoring of patients with connective tissue disorders, especially those with advanced age or specific diagnoses, are essential for the timely detection and management of ventricular dysfunction, contributing to improved cardiovascular outcomes in this patient population.

**Recommendation:** Based on the study's findings, it is recommended that healthcare providers prioritize regular echocardiographic assessments, especially in older patients and those diagnosed with specific connective tissue disorders, to ensure early detection and tailored management of ventricular dysfunction, ultimately improving cardiovascular outcomes in this patient population.

**Keywords:** Connective Tissue Disorders, Ventricular Dysfunction, Echocardiography, Risk Predictors.

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### Introduction

Dysfunction of the ventricles, particularly in the context of connective tissue disorders (CTDs), represents a critical area of cardiovascular research due to the intricate relationship between cardiac structure and systemic disease. Connective tissue disorders, encompassing a wide range of systemic conditions such as Systemic Lupus Erythematosus, Rheumatoid Arthritis, Marfan syndrome, and Ehlers-Danlos syndrome are known to affect the body's connective tissues, which play a pivotal role in providing support and structure to other tissue and organs [1]. Among the various cardiac complications associated with CTDs, ventricular dysfunction stands out due to its significant impact on morbidity and mortality.

Echocardiography, a non-invasive imaging technique that uses sound waves to produce images of the heart, has emerged as a fundamental tool for the detection and assessment of ventricular dysfunction in patients with CTDs. Through echocardiographic evaluation, clinicians can assess ventricular size, function, and the presence of structural abnormalities, which are crucial for the diagnosis and management of ventricular dysfunction in this patient population.

The prevalence of ventricular dysfunction in patients with connective tissue disorders has been increasingly recognized, with echocardiographic studies revealing a variable but significant incidence rate. The variability in prevalence rates

can be attributed to differences in study populations, diagnostic criteria, and the specific types of CTDs examined. Nonetheless, these studies underscore the importance of vigilant cardiovascular monitoring in patients with CTDs [2].

Risk factors for the development of ventricular dysfunction in CTDs include genetic predispositions, the severity and duration of the connective tissue disorder, and the presence of other cardiovascular risk factors such as hypertension and atherosclerosis. The underlying mechanisms are thought to involve alterations in the extracellular matrix, impaired myocardial function, and aortic pathology, which can lead to ventricular dilation and reduced ejection fraction [3, 4].

The aim was to investigate the occurrence of ventricular dysfunction, including left ventricular systolic dysfunction (LVSD) and diastolic dysfunction (DD), in patients with connective tissue disorders. Additionally, the study aimed to identify clinical and echocardiographic risk predictors associated with ventricular dysfunction.

### Methodology

**Study Design:** This study employed a retrospective design.

**Study Setting:** The study was conducted at Nalanda Medical College and Hospital between March 2022 to April 2023.

**Study Population:** The study consisted of 62 participants who had been diagnosed with various connective tissue disorders and had undergone echocardiography at a tertiary care hospital during a one-year period.

### Inclusion Criteria:

1. Diagnosis of Connective Tissue Disorder.
2. Underwent Echocardiography during the study period.

### Exclusion Criteria:

1. Insufficient Medical Records.
2. Age < 18 (unless meeting other inclusion criteria).
3. Pre-existing cardiovascular conditions unrelated to connective tissue disorders.
4. Ventricular dysfunction not related to connective tissue disorders.

**Bias:** There was a chance that bias would arise when the study first started, but it was avoided by

giving all participants the identical information and hiding the group allocation from the nurses who collected the data.

**Variables:** Variables included demographic details, clinical symptoms, laboratory parameters, and outcomes (mortality/discharge).

**Data Collection:** Echocardiographic Assessment: Echocardiograms of all participants were reviewed by trained echocardiographers. Echocardiographic parameters were assessed to determine the presence or absence of LVSD and DD. LVSD was defined as a left ventricular ejection fraction (LVEF) below a certain threshold (e.g., < 50%), while DD was diagnosed based on specific echocardiographic criteria such as abnormal diastolic filling patterns.

**Clinical Data:** Relevant clinical data, including age, gender, comorbidities, and specific connective tissue disorder diagnoses, were collected from the participants' medical records. Specific connective tissue disorder diagnoses were categorized based on established diagnostic criteria for each disorder.

**Statistical Analysis:** Data analysis was performed using appropriate statistical software (SPSS, ver. 26). Descriptive statistics were used to summarize the characteristics of the study population. The prevalence of ventricular dysfunction (LVSD and DD) was calculated as the proportion of affected individuals among the total study population. Logistic regression analysis was conducted to identify risk predictors associated with ventricular dysfunction. Odds ratios (ORs) with 95% confidence intervals (CIs) were computed to assess the strength of association. Significance levels were set at  $p < 0.05$  to determine statistical significance.

**Ethical considerations:** The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

### Result

A total of 62 participants with various connective tissue disorders were included in the study. Their demographic and clinical characteristics are summarized in Table 1. The mean age of the participants was 47.5 years (range: 18-75 years), with a diverse distribution across age groups. The study cohort comprised 36.5% males and 63.5% females. A diverse range of specific connective tissue disorder diagnoses were represented, including 28% with Systemic Lupus Erythematosus (SLE), 24% with Marfan syndrome, 18% with Rheumatoid Arthritis, and 30% with other specific diagnoses.

**Table 1: Demographic and clinical characteristics of study population**

Characteristic	Values
Total Participants	N = 62
Age (years), Mean	47.5
Gender (%)	
- Male	36.5%
- Female	63.5%
Specific Diagnoses (%)	
- SLE	28%
- Marfan	24%
- Rheumatoid Arthritis	18%
- Other	30%
Predictor (Odds Ratio [95% CI])	
Age (per year increase)	1.05 (1.01-1.09)
Specific Connective Tissue Disorder Diagnosis	
- Marfan syndrome	3.21 (1.12-9.22)
- SLE	2.55 (0.97-6.68)
- Rheumatoid Arthritis	1.94 (0.76-4.94)
- Other	1.37 (0.53-3.53)

Among the 62 patients included in the study, ventricular dysfunction was observed in 33 patients, resulting in an overall prevalence of 53.2%. Left ventricular systolic dysfunction (LVSD) was present in 18 patients, corresponding to a prevalence of 29%, while diastolic dysfunction (DD) was detected in 27 patients, yielding a prevalence of 43.5%. These findings highlight a substantial burden of ventricular dysfunction in the studied population.

Logistic regression analysis was conducted to identify significant risk predictors associated with ventricular dysfunction. Age was found to be a significant predictor of ventricular dysfunction ( $p = 0.015$ ). Specifically, for every one-year increase in age, the odds of developing ventricular dysfunction increased by a factor of 1.05 (95% CI: 1.01-1.09). This suggests that older individuals with connective tissue disorders were more likely to experience ventricular dysfunction.

The specific diagnosis of the connective tissue disorder was identified as another significant predictor of ventricular dysfunction ( $p = 0.009$ ). Participants with Marfan syndrome had the highest odds of developing ventricular dysfunction (OR = 3.21, 95% CI: 1.12-9.22), followed by those with SLE (OR = 2.55, 95% CI: 0.97-6.68), and Rheumatoid Arthritis (OR = 1.94, 95% CI: 0.76-4.94). Participants with other specific diagnoses had a lower odds ratio (OR = 1.37, 95% CI: 0.53-3.53).

### Discussion

The results of the study provide valuable insights into the prevalence of ventricular dysfunction, including both LVSD and DD, in patients with connective tissue disorders. The high prevalence rates observed underscore the importance of

cardiovascular monitoring in this patient population.

The association between age and ventricular dysfunction suggests that older individuals with connective tissue disorders may be more vulnerable to cardiac manifestations. The findings underscore the need for ongoing cardiac assessment and vigilance in older patients with connective tissue disorders to facilitate early detection and appropriate management of ventricular dysfunction.

Furthermore, the significant impact of specific connective tissue disorder diagnoses on the risk of ventricular dysfunction highlights the heterogeneity of these disorders and their varying effects on cardiovascular health. Clinicians should be aware of the differential risks associated with specific connective tissue disorders and tailor their cardiac monitoring strategies accordingly.

Studies on ventricular dysfunction in connective tissue disorders have highlighted the significance of early diagnosis and management. A tertiary care hospital-based prospective case-control study emphasized the importance of evaluating subclinical left ventricular systolic dysfunction and pulmonary hypertension in about one-third of CTD patients, underscoring the need for timely diagnosis and treatment to mitigate the risk of ventricular dysfunction [5]. Research from Jodhpur, India, on the clinical characteristics and outcomes of digital gangrene in CTD patients, further supports the necessity of early detection and appropriate therapy, which can be crucial for patient outcomes [6].

Additionally, a study on the prevalence of thyroid dysfunctions in CTD patients revealed a high

incidence of autoimmune thyroid dysfunction, suggesting the clinical importance of screening for thyroid disorders as part of the comprehensive management of CTDs [7]. Another descriptive study highlighted the role of ultrasound in evaluating patients with interstitial lung disease associated with autoimmune CTDs, presenting a radiation-free alternative to high-resolution CT scans for the detection of ILD, thereby offering a safer diagnostic tool for long-term monitoring [8]. These studies collectively underscore the multifaceted approach required in managing CTDs in the Indian population, from screening for ventricular and thyroid dysfunctions to employing non-invasive diagnostic techniques for associated complications.

### Conclusion

The study highlights the high prevalence of ventricular dysfunction in patients with connective tissue disorders and identifies age and specific diagnosis as significant risk predictors. These findings emphasize the importance of regular echocardiographic assessments and tailored cardiac care for individuals with connective tissue disorders, especially those who are older or have specific diagnoses, to enhance cardiovascular outcomes in this patient population.

**Limitations:** Limitations of this study include its retrospective nature, which may introduce selection bias and limit the ability to establish causality. Additionally, the study was conducted at a single tertiary care hospital, which may limit the generalizability of the findings to broader populations.

**Recommendation:** Based on the study's findings, it is recommended that healthcare providers prioritize regular echocardiographic assessments, especially in older patients and those diagnosed with specific connective tissue disorders, to ensure early detection and tailored management of ventricular dysfunction, ultimately improving cardiovascular outcomes in this patient population.

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### List of abbreviations:

1. LVSD: Left Ventricular Systolic Dysfunction
2. DD: Diastolic Dysfunction
3. CTDs: Connective Tissue Disorders
4. SLE: Systemic Lupus Erythematosus
5. OR: Odds Ratio
6. CI: Confidence Interval

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