ANS-LHS

OPEN ACCESS

Advanced Natural Sciences: Life and Health Sciences,
ISSN: 3107-636X, Vol-3, Issue-2,
July-Dec, 2026, 79-90
https://www.indjournals.com

Research Article

A Study of Clinical Presentation, Electrocardiographic, and Echocardiographic Changes in Patients with Dilated Cardiomyopathy

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DOI: 10.5281/zenodo.22790464

[Received 29-07-2026,
Accepted 12-09-2026,
Published 16-09-2026]

Abstract

Background: Dilated cardiomyopathy (DCM) is characterized by ventricular dilatation and impaired systolic function and may present with varying degrees of heart failure, arrhythmia, and structural cardiac abnormalities. Clinical examination, electrocardiography (ECG), and echocardiography are important for comprehensive assessment.

Aim: To evaluate the clinical presentation, ECG abnormalities, and echocardiographic changes in patients with DCM and to assess the relationship between clinical severity and cardiac imaging findings.

Materials and Methods: A prospective cross-sectional study was conducted in the Department of General Medicine, Katihar Medical College and Hospital, Bihar, from September 2024 to February 2026. A total of 100 patients aged >18 years with confirmed DCM were included. Clinical examination, 12-lead ECG, and transthoracic echocardiography were performed.

Results: The mean age was 49.65 ± 18.50 years, with 65% males and 35% females. NYHA Class II was most common (50%). Breathlessness (87%), fatigue (75%), and pedal edema (72%) were the leading symptoms. Rhythm abnormalities and conduction defects occurred in 76% each. LVEDD was ≥60 mm in 31%, while EF was 20–29% in 39%. Significant associations were observed between NYHA class and LVEDD (p=0.001) and EF (p=0.001), whereas LVESD was not significant (p=0.055).

Conclusion: Clinical assessment combined with ECG and echocardiography effectively characterizes DCM severity and identifies important structural and functional abnormalities.

Keywords: Dilated cardiomyopathy; Electrocardiography; Echocardiography; Heart failure; Ejection fraction; NYHA classification.

Cite this article: Ekta Sharma, PK Agrawal, Rohan Sharma and Mahvish Imtiyaz, 2026. A Study of Clinical Presentation, Electrocardiographic, and Echocardiographic Changes in Patients with Dilated Cardiomyopathy. Advanced Natural Sciences: Life and Health Sciences, 3(2), 79-90

Introduction

Dilated cardiomyopathy (DCM) is a clinically important myocardial disorder characterized predominantly by left ventricular or biventricular dilatation with impaired systolic function that cannot be explained solely by abnormal loading conditions or significant coronary artery disease. It represents a heterogeneous group of myocardial diseases with genetic, inflammatory, infectious, toxic, metabolic, endocrine and other acquired causes. The clinical course is variable, ranging from an asymptomatic structural abnormality to progressive heart failure, significant arrhythmias and sudden cardiac death [1,2]. Recent understanding of DCM emphasizes the importance of identifying the underlying aetiology because phenotypic presentation, prognosis and therapeutic strategies may differ considerably between patients [3].

Patients with DCM commonly present with symptoms related to impaired cardiac output and systemic or pulmonary congestion. Dyspnoea, fatigue, reduced exercise tolerance, palpitations, peripheral oedema and syncope are frequently encountered. On examination, elevated jugular venous pressure, displaced apex beat, third heart sound, basal pulmonary crepitations, peripheral oedema and congestive hepatomegaly may indicate the presence and severity of heart failure [2,4]. A systematic clinical assessment therefore remains an essential component of the initial evaluation.

Electrocardiography (ECG) provides important complementary information in patients with DCM. Abnormalities may include sinus tachycardia, atrial fibrillation, conduction disturbances, bundle branch blocks, axis deviation, chamber enlargement and ST-T abnormalities. ECG also assists in identifying arrhythmias and conduction abnormalities that may contribute to symptoms and influence prognosis [4,5]. Ventricular arrhythmias are particularly relevant because electrical remodelling and myocardial fibrosis can increase the risk of malignant arrhythmias and sudden cardiac death [5].

Echocardiography is central to the diagnosis and assessment of DCM. It permits evaluation of ventricular dimensions, global systolic function, left ventricular ejection fraction, diastolic function, chamber geometry and associated valvular or pericardial abnormalities [6]. Contemporary guidelines recommend transthoracic echocardiography as a key initial imaging investigation in patients with suspected heart failure, while serial assessment can help evaluate ventricular remodelling and changes in cardiac function [7]. The present study aimed to evaluate the clinical presentation and the electrocardiographic and echocardiographic changes in patients with dilated cardiomyopathy attending a tertiary care hospital. The study specifically assessed common clinical features, ECG abnormalities including rhythm, axis and chamber changes, and echocardiographic parameters such as ventricular dimensions and ejection fraction. It also aimed to determine the relationship between clinical severity and ECG and echocardiographic findings.

Materials and Methods

Study Design: A observational cross-sectional study was conducted to evaluate the clinical presentation and electrocardiographic and echocardiographic findings among patients with dilated cardiomyopathy.

Study Population: The study included adult patients diagnosed with dilated cardiomyopathy who attended the Outpatient Department, Emergency Department, Medicine wards, or Intensive Care Unit during the study period.

Sample Size: A total of 100 consecutive patients with dilated cardiomyopathy who fulfilled the predefined inclusion and exclusion criteria were enrolled in the study.

Study Duration: The study was conducted over 18 months, from September 2024 to February 2026, following approval from the Institutional Ethics Committee.

Study Setting/Location: The study was carried out in the Department of General Medicine, Katihar Medical College and Hospital, Katihar, Bihar.

Inclusion Criteria

1. Patients aged more than 18 years.
2. Patients of either sex.
3. Patients with a confirmed diagnosis of dilated cardiomyopathy.
4. Patients willing to participate in the study and provide written informed consent.

Exclusion Criteria

1. Patients with ischemic heart disease.
2. Patients with primary valvular heart disease causing ventricular dilatation.
3. Patients with congenital heart disease.
4. Patients with hypertrophic or restrictive cardiomyopathy.
5. Patients with severe systemic illnesses, such as advanced renal failure, chronic liver disease, or malignancy, that could confound the study findings.
6. Patients unwilling to provide informed consent.

Statistical Analysis

Data collected from all enrolled participants were systematically entered into Microsoft Excel and subsequently analysed using IBM SPSS Statistics version 27.0. Continuous variables were summarized as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. The distribution of clinical, electrocardiographic, and echocardiographic parameters was described using appropriate descriptive statistics. Associations between categorical variables, particularly NYHA functional class and ECG/echocardiographic findings, were assessed using the Chi-square test, while continuous variables were compared using the Student's t-test wherever applicable. The relationship between clinical severity and echocardiographic parameters such as LVEDD, LVESD, and ejection fraction was evaluated to determine their statistical significance. All statistical tests were two-sided, and a p-value <0.05 was considered statistically significant. The results were interpreted in relation to the study objectives, with emphasis on clinically relevant differences and statistically significant associations.

Results

Table 1. Baseline Demographic and Clinical Characteristics of the Study Participants

Variable		Number of Patients (n)	Percentage (%)
Age Group (years)	21–35	31	31
	36–50	19	19
	51–65	27	27
	66–80	23	23
	Mean Age (years)	49.65 ± 18.50	
Sex	Male	65	65
	Female	35	35
	Male: Female Ratio	1.86: 1	
NYHA Functional Class	Class I	17	17
	Class II	50	50
	Class III	26	26
	Class IV	7	7

Table 2. Clinical Presentation, Comorbidities, and Etiology of Dilated Cardiomyopathy

Variable		Number (n)	Percentage (%)
Presenting Symptoms	**Breathlessness**	87	87
	Fatigue	75	75
	Pedal edema	72	72
	Palpitations	39	39
	Syncope	24	24
Clinical Signs	**Displaced apex beat**	71	71
	Third heart sound (S3)	61	61
	Elevated JVP	54	54
	Murmurs	36	36
	Basal crepitations	24	24
	Gallop rhythm	15	15
	Congestive hepatomegaly	12	12
Comorbidities	**Hypertension**	42	42
	Diabetes mellitus	41	41
	Anemia	21	21
Etiology	**Nutritional cardiomyopathy**	18	18
	Peripartum cardiomyopathy	18	18
	Familial cardiomyopathy	17	17
	Idiopathic cardiomyopathy	17	17
	Viral myocarditis	16	16
	Alcoholic cardiomyopathy	14	14

Table 3. Electrocardiographic and Echocardiographic Findings Among Study Participants

Investigation Findings		Number (n)	Percentage (%)
Electrocardiographic Findings	**Rhythm abnormalities**	76	76
	Sinus tachycardia	39	39
	Atrial fibrillation	37	37
	Conduction defects	76	76
	AV block	36	36
	Right bundle branch block (RBBB)	23	23
	Left bundle branch block (LBBB)	17	17
	Axis deviation	69	69
	Right axis deviation	44	44
	Left axis deviation	25	25
	Chamber enlargement	66	66
	Left ventricular enlargement	37	37
	Biventricular enlargement	29	29
	ST–T wave changes	56	56
	Low-voltage complexes	26	26
2D Echocardiographic Findings	**LVEDD 45–49 mm**	24	24
	LVEDD 50–59 mm	45	45
	LVEDD ≥60 mm	31	31
	LVESD 35–40 mm	20	20
	LVESD 41–50 mm	49	49
	LVESD >51 mm	31	31
	Ejection Fraction 40–45%	26	26
	Ejection Fraction 30–39%	35	35
	Ejection Fraction 20–29%	39	39
	Pericardial effusion	20	20

Table 4. Association of NYHA Functional Classification with Echocardiographic Parameters

Parameter		NYHA Class I	NYHA Class II	NYHA Class III	NYHA Class IV	p-value
LVEDD (mm)	45–49	14 (82.4%)	10 (20.0%)	0 (0%)	0 (0%)	0.001
	50–59	3 (17.6%)	37 (74.0%)	5 (19.2%)	0 (0%)	
	≥60	0 (0%)	3 (6.0%)	21 (80.8%)	7 (100%)	
LVESD (mm)	35–40	3 (17.6%)	5 (10.0%)	10 (38.5%)	2 (28.6%)	0.055
	41–50	11 (64.7%)	25 (50.0%)	9 (34.6%)	4 (57.1%)	
	>51	3 (17.6%)	20 (40.0%)	7 (26.9%)	1 (14.3%)	
Ejection Fraction (%)	20–29	0 (0%)	26 (52.0%)	8 (30.8%)	5 (71.4%)	0.001
	30–39	5 (29.4%)	17 (34.0%)	11 (42.3%)	2 (28.6%)	
	40–45	12 (70.6%)	7 (14.0%)	7 (26.9%)	0 (0%)	

Figure: 1. Clinical Presentation, Clinical Signs, Comorbidities and Etiology in Dilated Cardiomyopathy

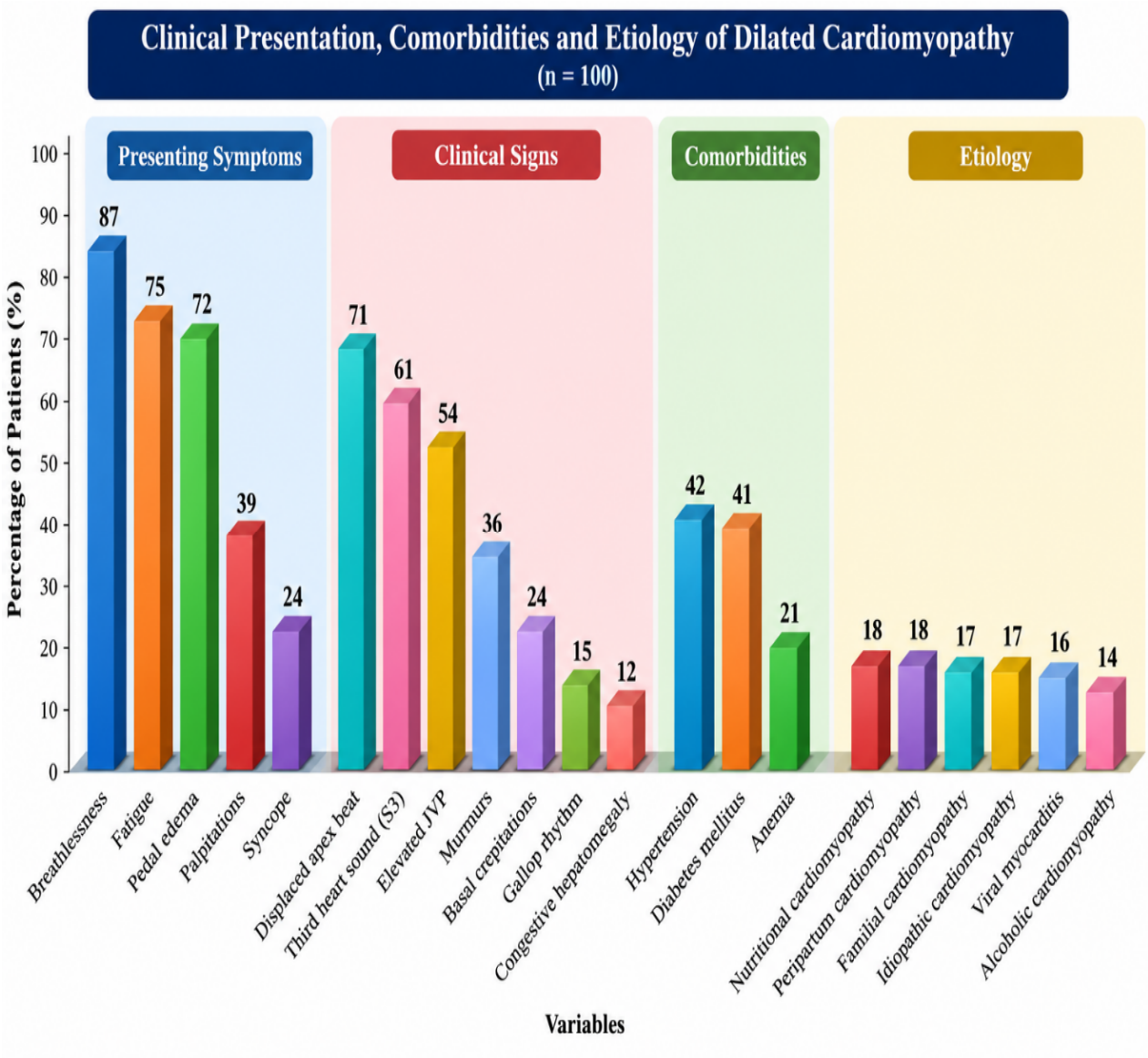
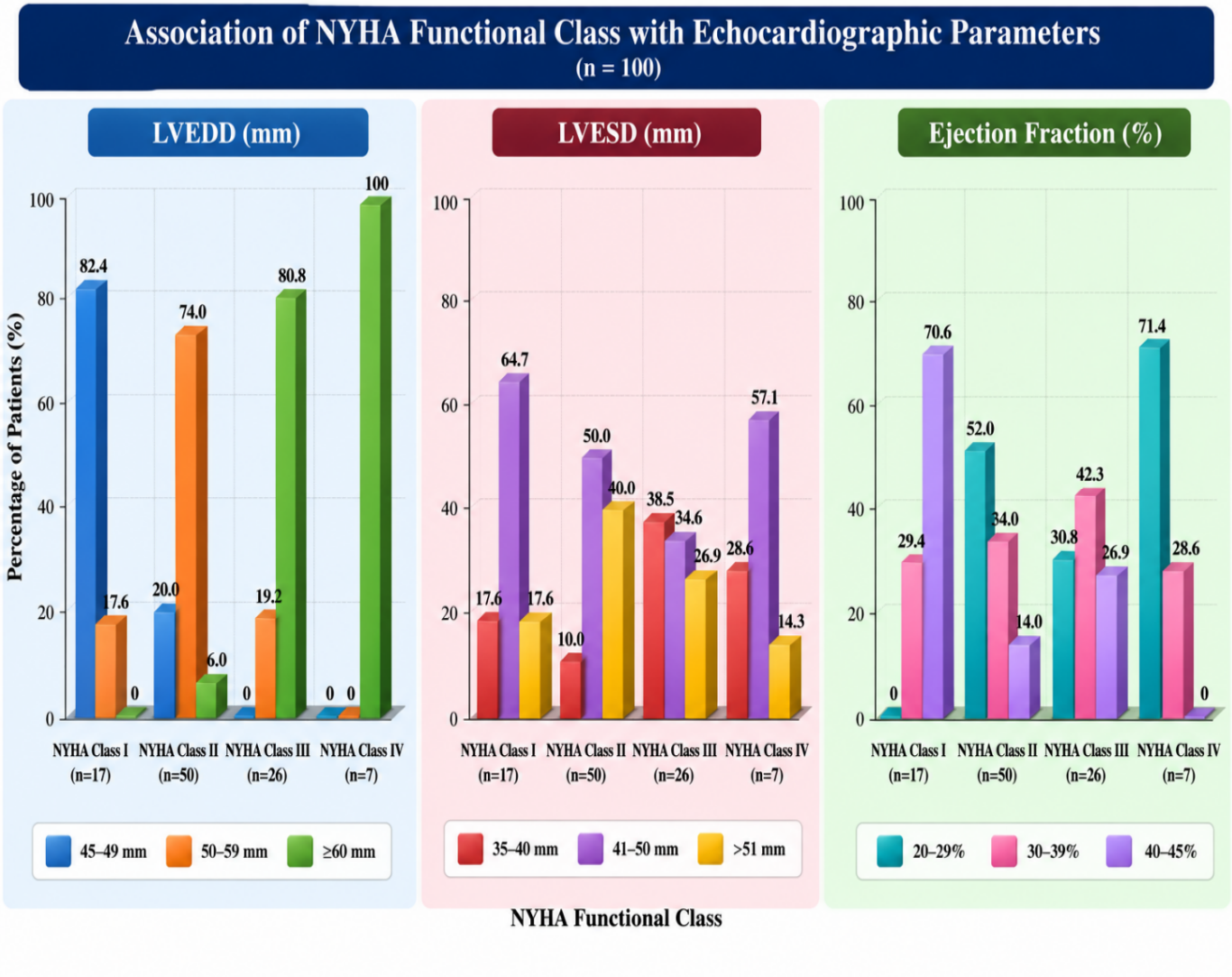


Figure: 2. Association of NYHA Class with Echocardiographic Parameters in Dilated Cardiomyopathy



A total of 100 patients with dilated cardiomyopathy were included in the study. The mean age of the participants was 49.65 ± 18.50 years. The largest proportion of patients belonged to the 21–35 years age group, comprising 31% (n=31) of the study population, followed by the 51–65 years group with 27% (n=27) and the 66–80 years group with 23% (n=23). Patients aged 36–50 years accounted for 19% (n=19). There was a clear male predominance, with 65 males (65%) and 35 females (35%), giving a male-to-female ratio of 1.86:1. Regarding functional status, most patients were classified as NYHA Class II, accounting for 50% (n=50) of the participants. This was followed by Class III in 26% (n=26), Class I in 17% (n=17), and Class IV in 7% (n=7). Thus, the majority of patients had mild-to-moderate functional limitation at presentation, although a substantial proportion had advanced symptomatic disease.

The most common presenting symptom was breathlessness, reported by 87% (n=87) of patients, followed by fatigue in 75% (n=75) and pedal edema in 72% (n=72). Palpitations were reported by 39% (n=39), while syncope was less frequent, occurring in 24% (n=24). On clinical examination, a displaced apex beat was the most frequently observed cardiovascular sign, present in 71% (n=71) of patients, indicating significant cardiac enlargement. A third heart sound (S3) was detected in 61% (n=61), while elevated JVP was present in 54% (n=54). Murmurs were documented in 36% (n=36), whereas basal

crepitations were found in 24% (n=24). Gallop rhythm and congestive hepatomegaly were observed in 15% (n=15) and 12% (n=12) patients, respectively. Among the recorded comorbidities, hypertension was the most frequent, affecting 42% (n=42), closely followed by diabetes mellitus in 41% (n=41). Anemia was present in 21% (n=21). With regard to etiology, nutritional cardiomyopathy and peripartum cardiomyopathy were the most frequently identified causes, each accounting for 18% (n=18). Familial and idiopathic cardiomyopathy each contributed 17% (n=17), while viral myocarditis and alcoholic cardiomyopathy accounted for 16% (n=16) and 14% (n=14), respectively. These findings demonstrate the heterogeneous clinical and etiological profile of DCM in the study population.

Electrocardiographic evaluation demonstrated a high frequency of abnormalities among the study participants. Rhythm abnormalities were identified in 76% (n=76) of patients, with sinus tachycardia in 39% (n=39) and atrial fibrillation in 37% (n=37). Conduction defects were also reported in 76% (n=76), including AV block in 36% (n=36), right bundle branch block in 23% (n=23), and left bundle branch block in 17% (n=17). Axis deviation was observed in 69% (n=69), comprising right axis deviation in 44% (n=44) and left axis deviation in 25% (n=25). Chamber enlargement was present in 66% (n=66), with left ventricular enlargement in 37% (n=37) and biventricular enlargement in 29% (n=29). ST–T wave changes were seen in 56% (n=56), while low-voltage complexes were documented in 26% (n=26). Echocardiographic assessment showed that 45% (n=45) had an LVEDD of 50–59 mm, while 31% (n=31) had marked dilatation with LVEDD ≥60 mm and 24% (n=24) had LVEDD of 45–49 mm. For LVESD, 49% (n=49) had values of 41–50 mm, while 31% (n=31) had LVESD >50 mm and 20% (n=20) had values of 35–40 mm. Regarding left ventricular systolic function, 39% (n=39) had an ejection fraction of 20–29%, 35% (n=35) had an EF of 30–39%, and 26% (n=26) had an EF of 40–45%. Thus, a substantial proportion of patients demonstrated marked ventricular dilatation and impaired systolic function. Pericardial effusion was detected in 20% (n=20) of patients.

A significant association was observed between NYHA functional class and LVEDD (p=0.001). Patients with better functional status generally had smaller ventricular dimensions, whereas marked LV dilatation was increasingly observed among patients with more advanced NYHA classes. In NYHA Class I, 82.4% (14/17) of patients had an LVEDD of 45–49 mm, compared with only 20% (10/50) in Class II and none in Classes III and IV. Conversely, LVEDD ≥60 mm was present in 80.8% (21/26) of Class III patients and 100% (7/7) of Class IV patients. This indicates a strong relationship between increasing ventricular dilatation and worsening functional status. In contrast, the association between LVESD and NYHA class was not statistically significant (p=0.055), although some variation across functional classes was observed. Regarding ejection fraction, a statistically significant association was found with NYHA class (p=0.001). An EF of 20–29% was present in 52.0% (26/50) of Class II patients, 30.8% (8/26) of Class III patients, and 71.4% (5/7) of Class IV patients, while none of the Class I patients had an EF below 30%. Conversely, an EF of 40–45% was most common among Class I patients (70.6%, 12/17) and decreased progressively among Class II (14.0%, 7/50) and Class III (26.9%, 7/26) patients, with none of the Class IV patients having an EF in this range. Overall, the findings suggest that greater LV dilatation and reduced systolic function were associated with poorer NYHA functional status, with LVEDD and ejection fraction showing statistically significant relationships.

Discussion

The present study evaluated the clinical profile, electrocardiographic abnormalities and echocardiographic characteristics of 100 patients with dilated cardiomyopathy (DCM). Overall, the findings demonstrate that DCM in this cohort was associated with a predominantly

male presentation, frequent symptoms of congestive heart failure, multiple ECG abnormalities, substantial left ventricular dilatation and impaired systolic function. These observations are broadly consistent with contemporary studies, although some differences were evident in the frequency of individual clinical and investigative findings.

In the present study, the mean age of the participants was 49.65 ± 18.50 years, with the largest proportion belonging to the 21–35-year age group (31%), followed by 51–65 years (27%). Males constituted 65% of the study population, giving a male-to-female ratio of 1.86:1. This male predominance is comparable with the findings of Murali et al., who reported that 62.5% of their 120 DCM patients were male, although their cohort had a somewhat higher mean age of 58 years [7]. Similarly, a South Asian study reported a markedly higher proportion of males (76%) and a younger mean age of 38.7 years [8]. The relatively high representation of younger patients in the present study may reflect differences in referral patterns, regional disease characteristics and the contribution of familial, nutritional and other non-ischaemic causes.

The predominance of males in the present study is also consistent with contemporary prospective data. Owen et al. reported 398 males and 206 females in a cohort of 604 patients with DCM [9]. Their study further demonstrated sex-related differences in ventricular phenotype, suggesting that sex may influence both the structural presentation and subsequent clinical course of DCM. In the present study, 50% of patients were NYHA Class II, while 26% were Class III and 7% were Class IV. Thus, most participants had symptomatic disease but were not in the most advanced functional category. Similar predominance of NYHA Class I–II disease has been reported in contemporary DCM cohorts [10].

Breathlessness was the commonest presenting symptom (87%), followed by fatigue (75%) and pedal edema (72%). This pattern is consistent with the clinical presentation expected from impaired ventricular systolic function and consequent pulmonary and systemic congestion. Aryal reported breathlessness in 84.5% of patients with DCM, while another South Asian cohort found dyspnoea in 90.7% of patients [8,11]. The close similarity supports the observation that exertional or resting breathlessness remains the dominant clinical manifestation of DCM across different populations.

Pedal edema was present in 72% of our patients, reflecting the substantial burden of systemic venous congestion. The frequency was comparable with the 66.7% reported in the South Asian cohort described by Shrestha et al. [8]. Palpitations occurred in 39%, while syncope was observed in 24%. These symptoms are clinically important because they may reflect atrial or ventricular arrhythmias, conduction abnormalities or reduced cardiac output.

On examination, displaced apex beat (71%) was the most frequent finding, followed by S3 (61%) and elevated JVP (54%). These findings are compatible with significant ventricular enlargement and haemodynamic consequences of DCM. Murali et al. reported displaced apex beat in 54.2%, raised JVP in 58.3%, and added heart sounds in 75% of patients [7]. The somewhat lower frequency of basal crepitations in our study (24%) compared with their reported 79.2% may reflect differences in disease severity, treatment before assessment or timing of clinical examination. Congestive hepatomegaly was found in only 12% of our participants, suggesting that overt systemic congestion was less universal than symptoms such as pedal edema.

Hypertension (42%) and diabetes mellitus (41%) were the most frequent comorbidities in our cohort. These proportions were higher than those reported by Amin et al., who observed hypertension in 31.7% and diabetes in 10% of their DCM cohort [10]. However, differences in age distribution, population characteristics and criteria for recording comorbidities may account for this variation. The presence of these conditions also emphasizes the importance of carefully distinguishing primary non-ischaemic

DCM from ventricular dysfunction associated with other cardiovascular risk factors.

The etiological distribution in the present study was relatively heterogeneous. Nutritional and peripartum cardiomyopathy each accounted for 18%, followed by familial and idiopathic cardiomyopathy at 17% each, viral myocarditis at 16%, and alcoholic cardiomyopathy at 14%. This distribution illustrates the multifactorial nature of DCM. Contemporary literature increasingly emphasizes that apparently idiopathic DCM may represent a mixture of genetic, inflammatory, toxic and other acquired myocardial disorders rather than a single disease entity [10].

Amin et al. demonstrated that incorporating genetic testing and cardiac magnetic resonance substantially changed the presumed aetiological classification of DCM, with fewer cases remaining classified as idiopathic after additional investigations [10]. Their findings are relevant to the present study because the relatively high proportion of familial and idiopathic cases may partly reflect the limitations of routine clinical and laboratory evaluation. The occurrence of 18% peripartum cardiomyopathy is also notable in the present cohort. Indian studies have demonstrated considerable clinical heterogeneity in peripartum cardiomyopathy, supporting its recognition as an important cause of systolic heart failure in women of reproductive age [12].

ECG abnormalities were very common in the present study. Rhythm abnormalities were identified in 76% of patients, including sinus tachycardia in 39% and atrial fibrillation in 37%. Conduction abnormalities were also reported in 76%, while axis deviation and chamber enlargement occurred in 69% and 66%, respectively. ST–T changes were present in 56%, and low-voltage complexes in 26%.

The high frequency of ECG abnormalities is consistent with the known electrical remodelling that accompanies DCM. Chayanopparat et al., in a cohort of 422 patients, found several ECG abnormalities to be clinically relevant, particularly intraventricular conduction delay, low voltage and repolarization abnormalities; these ECG features were also associated with myocardial fibrosis and adverse outcomes [13]. Their cohort had a lower overall frequency of atrial fibrillation than the present study, indicating that the particularly high AF prevalence in our population may reflect differences in disease duration, age, atrial remodelling or referral severity.

In the present study, RBBB was present in 23% and LBBB in 17%. Amin et al. reported LBBB in approximately 27.5% of their idiopathic DCM cohort [10]. Although the proportions are not identical, both studies demonstrate that intraventricular conduction abnormalities are common in DCM. Such abnormalities are clinically relevant because conduction delay may contribute to ventricular dyssynchrony and can influence decisions regarding device-based therapy.

Echocardiography demonstrated substantial ventricular dilatation in the present cohort. Forty-five percent of patients had an LVEDD of 50–59 mm, while 31% had LVEDD ≥60 mm. Similarly, LVESD was 41–50 mm in 49% and >50 mm in 31%. These findings indicate that a considerable proportion of patients had marked structural remodelling by the time of clinical assessment.

These observations are broadly comparable with previous studies. A South Asian cohort reported a mean LVEDD of 52.89 ± 8 mm and mean LVESD of 42.8 ± 10 mm, demonstrating substantial ventricular enlargement [8]. In another large cohort, idiopathic DCM patients had an average LVEDD of approximately 64 mm, further illustrating the degree of ventricular dilatation that can occur in established disease [14]. Echocardiography therefore remains particularly valuable for documenting ventricular size and systolic impairment and for monitoring changes over time. Contemporary reviews also emphasize that LV dimensions and LVEF remain fundamental components of echocardiographic assessment in DCM [9].

Regarding systolic function, 39% of patients had an EF of 20–29%, 35% had EF 30–39%, and only 26% had EF 40–45%. Thus, most patients had significant LV systolic dysfunction.

Similar severity has been documented in other DCM cohorts; for example, a South Asian study reported a mean echocardiographic EF of 26.4% ± 15% [8]. The predominance of markedly reduced EF in the present study is consistent with the clinical observation that many patients presented with symptomatic heart failure rather than being identified incidentally.

A particularly important finding was the significant association between NYHA functional class and LVEDD ($p=0.001$). Only 17.6% of Class I patients had LVEDD 50–59 mm, whereas 80.8% of Class III patients and 100% of Class IV patients had LVEDD ≥60 mm. This progressive increase in ventricular size with worsening functional class supports the relationship between adverse ventricular remodelling and clinical severity.

The association between ejection fraction and NYHA class was also statistically significant ($p=0.001$). No Class I patient had an EF of 20–29%, whereas this severe reduction was present in 71.4% of Class IV patients. Conversely, an EF of 40–45% was observed in 70.6% of Class I patients but in none of the Class IV patients. These findings are consistent with contemporary evidence identifying LVEF and NYHA functional status as important markers of disease severity and prognosis in DCM [9]. However, the relationship is not absolute, because symptoms are influenced by several factors beyond LVEF, including diastolic function, right ventricular involvement, pulmonary pressures, rhythm abnormalities and functional mitral regurgitation.

In contrast, LVESD showed no statistically significant association with NYHA class ($p=0.055$). Although there were numerical differences across the functional groups, the association did not reach the conventional threshold for statistical significance. This finding suggests that LVESD alone may be less closely related to functional limitation than the overall degree of LV dilatation and systolic impairment. Contemporary echocardiographic literature similarly supports the use of multiple structural and functional parameters rather than relying on a single measurement when assessing DCM [9].

Overall, the present findings are in agreement with contemporary research showing that DCM is a heterogeneous disorder characterized by diverse clinical manifestations, electrical abnormalities and structural remodelling. The significant relationships between NYHA class, LVEDD and EF further support the value of combining clinical assessment with echocardiographic evaluation. At the same time, the differences in the prevalence of individual findings compared with other studies highlight the influence of demographic, geographical, etiological and referral-related factors on the observed phenotype.

Conclusion

The present study highlights the diverse clinical, electrocardiographic, and echocardiographic manifestations of dilated cardiomyopathy in patients attending a tertiary care hospital. The study population showed a male predominance, with most patients presenting in NYHA Class II. Breathlessness, fatigue, and pedal edema were the most frequent symptoms, while displaced apex beat, S3, and elevated JVP were the commonest clinical signs. Hypertension and diabetes were frequent associated comorbidities, whereas nutritional and peripartum cardiomyopathy were the leading identified etiologies. ECG abnormalities were highly prevalent, particularly rhythm disturbances, conduction defects, axis deviation, chamber enlargement, and ST–T changes. Echocardiography demonstrated considerable left ventricular dilatation and impaired systolic function, with a substantial proportion having markedly reduced ejection fraction. Importantly, LVEDD and ejection fraction showed significant associations with NYHA functional class, indicating their value in assessing disease severity. Overall, integrating clinical assessment with ECG and echocardiography provides a comprehensive approach to characterizing DCM and identifying patients with more advanced disease.

Acknowledgments: None stated

Use of Artificial Intelligence

The authors declare that no generative artificial intelligence tools were used to generate the scientific content, analysis, or conclusions of this manuscript.

Ethical Statement

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethics Committee, and written informed consent was obtained from all participants. Participant confidentiality and privacy were maintained throughout the study.

Conflict of interest

The authors declare that they have no conflict of interest related to this study, its findings, or its publication.

Funding

The authors declare that no specific funding was received from any governmental, commercial, or not-for-profit organization for conducting this study.

Data availability

The data analyzed during the present study are available from the corresponding author on reasonable request, subject to institutional and ethical restrictions concerning participant confidentiality.

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