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ORIGINAL RESEARCH

Echocardiographic Evaluation and Clinical Profile of Dilated Cardiomyopathy Cases: A Cross-Sectional Observational Study in a Tertiary Care Teaching Hospital of South Odisha

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Abstract

Introduction: Dilated Cardiomyopathy (DCM) is a cardiac disorder characterized by the dilation and impaired contraction of the left ventricle or both ventricles. It is a significant cause of heart failure and cardiac transplantation worldwide.

Aims & Objectives: The aims and objectives of the study are:

1. To evaluate cases of dilated cardiomyopathy by 2D-Echocardiogrpahy and identify various etiology factors.
2. To analyze the clinical profile of patients with dilated cardiomyopathy.

Methods: A cross-sectional observational study was conducted, involving patients diagnosed with DCM through echocardiography. Clinical data, including symptoms, risk factors, and comorbidities, were collected and analyzed.

Results: This study analyzed 69 patients with DCM, an enlarged and weak heart condition. The patients were mostly male, aged 51-60, and had dyspnea as the main symptom. Other symptoms and signs were PND, pedal edema, hepatomegaly and raised JVP. Ischemic heart disease was the main cause of DCM. The table shows the NYHA Functional Classification of symptom severity. Most patients had symptoms at rest (category IV) and none had no limitation in physical activity (category I). Sixteen patients had no NYHA grade. The table shows the ECG and echocardiographic changes in the patients. Normal QRS axis was the most common ECG change. Mitral regurgitation was the most common echocardiographic abnormality. LA size and RV size were significantly related to symptom severity.

Conclusion: Our study shows the common symptoms and signs of heart failure, such as dyspnea and raised JVP. It also finds a high prevalence of pedal edema, which differs from other studies and needs more research. The study reveals that LA and RV size, but not EF

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and LVEDD, are linked to symptom severity. The mean ejection fraction is low, indicating poor heart function. This matches the description of HFrEF in other studies. The findings enhance the knowledge of heart failure and its related factors. More research is required to understand these factors and their impact on patient care.

Introduction

Dilated cardiomyopathy (DCM), one of the most common cardiomyopathies causes heart failure (HF) worldwide. It is less common than coronary artery disease (CAD), it affects mainly young adults and presents the most frequent reason for cardiac transplantation at a younger age. According to the European Society of Cardiology (ESC), the current definition of DCM includes the presence of a dilated and poorly functioning left ventricle or both ventricles.[1]

A wide variety of genetic and non-genetic etiologies come under the umbrella terms of DCM, leading to left ventricular systolic dysfunction and dilatation, not explained by abnormal loading conditions or coronary artery disease.

DCM is a heart muscle disease characterized by enlargement and dilation of one or both ventricles along with impaired contractility defined as left ventricular ejection fraction (LVEF) <40%. Patients have systolic dysfunction and may or may not have overt symptoms of heart failure (HF).[2]

The prevalence of DCM in the general population is unknown. The reported numbers considerably vary due to non-homogeneous study methodologies, which are mainly related to inconsistent definitions and classifications of DCM. In addition, the prevalence of DCM varies according to geographic and ethnic differences. DCM is more commonly seen in men than in women. Its prevalence is estimated at 36 cases per 100,000. DCM accounts for 10,000 deaths and 46,000 hospitalizations in the United States annually. In 2015, the Global Burden of Disease study estimated the global prevalence of cardiomyopathy at 2.5 million cases - an increase of 27% in just 10 years. These figures may underestimate the true prevalence because many patients are asymptomatic and, therefore, undiagnosed despite LV dysfunction.[3]

DCM has many causes and all of them affect the ventricular function to a varying degree. While most patients with DCM have symptoms, a few patients may be asymptomatic because of the compensatory mechanisms. The continued enlargement of the ventricles leads to a decline in ventricular function, followed by conduction system abnormalities, ventricular arrhythmias, thrombo-embolism, and heart failure. Earlier identification of these patients followed by earlier initiation of treatment can lead to better prognosis.

Classic symptoms include paroxysmal nocturnal dyspnea, orthopnea, leg swelling, and shortness of breath. Nonspecific symptoms of fatigue, malaise, and weakness also can be present. More severe cases can present with thromboembolic complications, conduction disturbances, arrhythmias, or even sudden cardiac death. Physical examination findings are largely not specific to other causes of cardiomyopathy and consist of typical findings seen with congestive heart failure.

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Findings include crackles in the lung fields, elevated jugular venous pressures, peripheral edema, and an S3 gallop. Classically, the point of maximum impulse or PMI is displaced laterally. Tricuspid or mitral regurgitation murmurs are common due to ventricular enlargement and annular dilation. Neck examination may reveal jugular venous distension, A-wave, large V waves, and positive hepatojugular reflux.

Many cases of dilated cardiomyopathy (DCM) are due to idiopathic etiology. But it also can arise from various myocardial insults. Enlargement of the ventricles can either be secondary to LV failure or secondary to a primary cardiomyopathic process and can be associated with both systolic and diastolic dysfunctions. Reduction in systolic function is believed to be caused by myocardial remodeling that increases both end-systolic and end-diastolic volumes.

DCM is typically diagnosed between 20 and 50 years of age. Dilated chambers are readily identified using echocardiography; the diagnostic criteria are LV end-diastolic volumes or diameters >2 standard deviations from normal according to normograms (*z*-scores >2 s.d.) corrected for age and body surface area and ejection fraction <50%. Electrocardiography (ECG) in patients with DCM may be remarkably normal, but abnormalities ranging from isolated T wave changes and left bundle branch block to prolongation of atrioventricular conduction can occur. Sinus tachycardia and supraventricular arrhythmias are common; ~20–30% of patients have non-sustained ventricular tachycardia. Cardiac catheterization may be performed to rule out coexisting coronary artery disease and cardiac MRI may assist with imaging dilatation & is used to determine the presence of edema and/or fibrosis which are suggestive of inflammation.[4]

In the Southern part of Odisha, the prevalence and incidence of HF due to DCM is very significant. Despite many patients with HF due to DCM, very few studies have been conducted about the clinical profile and echocardiographic abnormalities. Thus,exact epidemiologicaldata on cardiomyopathy in Southern Odisha are lacking. Because of the high prevalence and the increasing use of echocardiography, the incidence of cardiomyopathy is increasing. The present study analyzes the etiology and clinical profile of patients with DCM in the Southern Odisha region.

Aims & Objectives

The aims and objectives of the study are:

1. To evaluate cases of dilated cardiomyopathy by 2D-Echocardiogrpahy and identify various etiology factors.
2. To analyze the clinical profile of patients with dilated cardiomyopathy

Materials and Methods: -

This cross-sectional observational study was conducted in the Department of General Medicine and Cardiology, M.K.C.G. Medical College & Hospital, Berhampur, Odisha between October 2022 to September 2023.

Sample Size: -

The prevalence of dilated cardiomyopathy was 6.95% as per the previous study conducted by Rakar S et.al. [1]

Based on this prevalence the sample size was estimated tobe 69.

Sample size (n) $= Z^2pq/d^2$

Z = 1.96

p = 6.95%

q = 100-6.95= 93.05

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d = 6

Sample Size = $(1.96)^2*6.95*93.05/6^2$

= 69.0 cases.

SELECTION CRITERIA

Inclusion Criteria

1. **Clinical criteria:**
   - Patients with symptoms and signs of heart failure.
2. **ECHO criteria:**
   - Left ventricular ejection fraction < 45%
   - Global hypokinesia of LV
   - Dilatation of all the chambers of the heart
   - Left ventricular end-diastolic dimension > 3 cm/body surface area.

Exclusion Criteria

1. Pericardial disease
2. Cor pulmonale with CHF.
3. Hypertrophic cardiomyopathy
4. Restrictive cardiomyopathy
5. Congenital heart disease
6. Coronary artery disease

Study Procedure: -

The participants included in this study were subjected to history-taking, detailed physical examination, and laboratory investigation like blood urea, creatinine, CBC, sodium, potassium, magnesium, LFT, ECG, X-ray of Chest, Echocardiography, Thyroid profile, FBS, PPBS, HbA1c, EF, LVEDD, LESDD, and their findings were recorded in a predesigned case record form(CRF).

Statistical Analysis: -

The data was compiled using Microsoft Excel, standard spreadsheet software. Data were analysed using Fisher's exact test, and Chi-square test with the statistical software SPSS statistical software version 22. $P < 0.05$ was considered statistically significant.

Results:-

Table No. 1. Demographic profile

Age groups (Years)	No. of patients (N)	Percentage (%)
≤40	9	13.1
41-50	11	15.9
51-60	23	33.3
61-70	11	15.9
71-80	13	18.9
>80	2	2.9
Gender		
Male	49	71
Female	20	29

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The total number of patients in the study was 69, with a mean age of 58.4 years (SD = 12.6). Most of the patients were male (71%) and in the 51-60 age group (33.3%).

Table No. 2. Distribution Based on Symptoms and Signs of Dilated Cardiomyopathy

Symptoms	No. of patients (N)	Percentage (%)
Easily fatigued	41	59.4
Chest pain	37	53.6
Syncope	9	13.1
Dyspnea	53	76.8
Orthopnoea	41	59.4
Palpitation	40	58
PND	43	62.3
Pedal edema	42	60.9
Cough	41	59.4
Abdominal pain	38	55.1
Signs		
Tachycardia	40	58
Bradycardia	4	5.8
Drop beats	27	39.1
Raised JVP	50	72.5
Hepatomegaly	45	65.2
Basal crepitation	41	59.4
Murmur	11	15.9

The most common symptom was dyspnea, which affected 53 patients (76.8%), followed by PND, pedal edema, and hepatomegaly, which each affected more than 60% of the patients. The least common symptom was syncope, which only affected 9 patients (13.1%). Among the signs, the most prevalent was raised JVP, which was observed in 50 patients (72.5%), while the least prevalent was bradycardia, which was observed in only 4 patients (5.8%).

Table 3: Distribution Based on Signs Of Dilated Cardiomyopathy

Signs of DCM	No. of patients (N)	Percentage (%)
Tachycardia	40	58
Bradycardia	4	5.8
Drop beats	27	39.1

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Raised JVP	50	72.5
Hepatomegaly	45	65.2
Basal crepitation	41	59.4
Murmur	11	15.9

Table 4: Distribution of Etiology and Risk Factors of Dilated Cardiomyopathy

Etiology of DCM	**No. of patients (N)**	**Percentage (%)**
Diabetic	14	20.3
Peripartum	8	11.6
Ischemic	21	30.4
Alcoholic	12	17.4
Idiopathic	14	20.3
Total	69	100
Risk factors		
Smoking	18	26.1
Alcoholism	26	37.7
Hypertension	40	58
Diabetes mellitus	22	31.9
Dyslipidaemia	19	27.5
Previous MI	9	13.1

The most common cause of DCM was ischemic heart disease, which affected 21 patients (30.4%), followed by diabetic and idiopathic DCM, which each affected 14 patients (20.3%). Peripartum DCM was the least common cause, affecting only 8 patients (11.6%). Among the risk factors, hypertension was the most prevalent, affecting 40 patients (58%), followed by alcoholism, which affected 26 patients (37.7%). Previous myocardial infarction (MI) was the least prevalent risk factor, affecting only 9 patients (13.1%).

Table 5: Distribution Based On Nyha Grades

NYHA grades	**No. of patients (N)**	**Percentage (%)**
I	**0**	**0**
II	**11**	**15.9**
III	**14**	**20.3**

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IV	**28**	**40.6**
None	**16**	**23.2**
Total	**69**	**100**

The table shows how 69 patients with heart failure were classified according to the New York Heart Association (NYHA) Functional Classification, which measures the impact of the disease on their daily activities. The table reveals that none of the patients belonged to the first category, which means that they all experienced some degree of limitation in their physical activity. Most of the patients (40.6%) were in the fourth and most severe category, indicating that they had symptoms even at rest and could not perform any physical activity without discomfort. The second most common category was the third one, with 20.3% of the patients, followed by the second one, with 15.9% of the patients. These categories meant that the patients had marked or slight limitations in their physical activity, respectively. The table also shows that 16 patients (23.2%) did not have any NYHA grade assigned, which could imply that they were either not assessed or had other conditions that affected their functional status.

Table 6: Distribution of ECG Changes Observed

ECG changes	No. of patients (N)	Percentage (%)
QRS axis		
• Normal	52	75.4
• Left axis deviation	11	15.9
• Right axis deviation	6	8.7
• ST-T changes	20	29
Atrial enlargement		
• Left atrial enlargement	8	11.6
• Right atrial enlargement	5	7.2
Ventricular hypertrophy		
• Left ventricular hypertrophy	12	17.4
• Right ventricular hypertrophy	7	10.1
• Both LVH+RVH	24	34.78
Atrial fibrillation	12	17.39
Intraventricular conduction delay	20	28.98
Q-wave	8	11.59
Heart Block	8	11.59
VPC & VT	12	17.39
PSVT	4	5.79

The table also shows that some ECG changes were more prevalent than others, such as ventricular hypertrophy, atrial fibrillation, and intraventricular conduction delay. Ventricular hypertrophy, which means enlargement of the lower chambers of the heart, was observed in 43 patients (62.32%), either in the left, right, or both ventricles. Atrial fibrillation, which means irregular and fast heart rhythm, was observed in 12 patients (17.39%). Intraventricular

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conduction delay, which means delayed electrical impulses in the lower chambers of the heart, was observed in 20 patients (28.98%).

Table 7: Distribution of Echocardiography Findings

Echo findings	No. of patients (N)	Percentage (%)
Ejection fraction	Mean±SD = 31.65±7.3%	Min-Max: 18-44%
40%-45%	9	13
30-39%	32	46.4
20-29%	24	34.8
<20%	4	5.8
LVEDD	Mean±SD = 5.96±0.8 cm	Min-Max: 4.5-6.9 cm
4.5-4.9 Cm	11	15.9
5.0-5.9 Cm	21	30.4
>6 Cm	37	53.6
LVESD	Mean±SD = 4.9±0.6 cm	Min-Max: 3.5-5.6 cm
3.5-4 Cm	10	14.5
4-4.9 Cm	22	31.9
>5 Cm	37	53.6
Mitral regurgitation	47	68.1
Tricuspid regurgitation	3	4.3
Atrial regurgitation	2	2.9
Pericardial effusion	5	7.2
Left ventricular clot	0	
PAH	4	5.79
Diastolic dysfunction	6	8.6
Left Atrial Enlargement	34	49.27
Right Ventricular Enlargement	24	34.78

The least common abnormalities were tricuspid regurgitation, atrial regurgitation, and left ventricular clots, which were observed in 3, 2, and 0 patients, respectively.

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, indicating a reduced pumping ability of the heart. , indicating an enlargement of the left lower chamber of the heart.

Table 8: Association of Echocardiographic Features with Clinical Outcomes

Variables	Severe symptoms	Mild to moderate symptoms	p-value
EF<35%	18	23	0.233
EF>35%	9	21	
LA size>40 mm	22	17	0.000*
LA size<40 mm	4	26	
RV size>26 mm	16	12	0.000*
RV size<26 mm	5	36	
LVEDD>52 mm	20	29	0.522
LVEDD<52 mm	3	7	

The table reveals that LA size and RV size are significantly associated with the severity of symptoms, with p-values of 0.000 for both variables. This means that patients with larger LA and RV are more likely to have severe symptoms than those with smaller LA and RV. On the other hand, EF and LVEDD are not significantly associated with the severity of symptoms, with p-values of 0.233 and 0.522, respectively. This means that there is no clear difference in the distribution of EF and LVEDD between patients with severe and mild to moderate symptoms.

Discussion:-

Dilated Cardiomyopathy (DCM) is the most prevalent type of cardiomyopathy that leads to Heart Failure, albeit less frequently than Coronary Artery Disease (CAD). It is caused by a broad spectrum of both genetic and non-genetic factors, which result in Left Ventricular (LV) systolic dysfunction and dilation. DCM is a disease of the heart muscle, characterized by the enlargement and dilation of one or both ventricles, coupled with impaired contractility. This is defined by a Left Ventricular Ejection Fraction (LVEF) of less than 40%. Patients exhibit systolic dysfunction and may or may not display overt symptoms of Heart Failure (HF).[2]

In a clinical context, certain signs can be observed that indicate specific conditions. These include the presence of crackles in the lung fields, an increase in jugular venous pressures, the occurrence of peripheral edema, and the detection of an S3 gallop. Murmurs associated with tricuspid or mitral regurgitation can be attributed to the enlargement of the ventricle and dilation of the annulus. Upon examination of the neck, one may notice distension of the jugular veins, the presence of an A-wave, large V waves, and a positive hepato-jugular reflux. These signs are all clinically significant and can provide valuable insights into a patient's health status.

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Our study enrolled 69 patients out of which 71% were males [49] and 29% were females[20]. The mean age was found to be 58.4 years (SD = 12.6) in the study. The age group which was found to be maximum was between 51-60 years (33.3%).

From Table 2, the data from the study indicates that the most common symptom among the patients was dyspnea, affecting 76.8% of the patients. This is followed by Paroxysmal Nocturnal Dyspnea (PND), pedal edema, and hepatomegaly, each affecting more than 60% of the patients. The least common symptom was syncope, affecting only 13.1% of the patients. Among the signs, raised Jugular Venous Pressure (JVP) was the most prevalent, observed in 72.5% of the patients, while bradycardia was the least prevalent, observed in only 5.8% of the patients. A study by McHorneyand Mansukhani etal 2021, reported that the most commonly reported symptoms in heart failure patients were shortness of breath (81.3%), fatigue/tiredness (76.6%), swelling of legs and ankles (57.8%), and trouble sleeping (50.0%). This aligns with our data where dyspnea, a form of breathlessness, was the most common symptom.[5]Another study on the prevalence of pedal edema by *Yeboah, Bertoni, Qureshi, and Aggarwal* in 2016 found that it was present in 28% of the participants, which is significantly lower than the over 60% prevalence in our data.[6]A study published by *King-Kingery-Casey* in the American Family Physician in 2012, mentioned that a displaced cardiac apex, a third heart sound, and chest radiography findings of venous congestion or interstitial edema are useful in identifying heart failure. However, these signs were not found in our study.[7]

JVP raised was the most found sign in our study followed by hepatomegaly as per findings of our study. It is consistent with the findings of Giri and Mukhopadhyayet al. (July 2021). Hepatomegaly, or enlargement of the liver, can occur in Dilated Cardiomyopathy (DCM) due to various reasons. Recent genetic studies mention that mutations in genes encoding proteins localized to the cytoskeleton, sarcomere, ion channels, Z-disc, mitochondria, nuclear proteins, cardiac transcription factors, and factors involved in calcium homeostasis have been identified and found to be implicated in both familial and sporadic DCM cases[8].
In Table 4, the most common cause of DCM was ischemic heart disease, which affected 21 patients (30.4%), followed by diabetic and idiopathic DCM, which each affected 14 patients (20.3%). Peripartum DCM was the least common cause, affecting only 8 patients (11.6%). Among the risk factors, hypertension was the most prevalent, affecting 40 patients (58%), followed by alcoholism, which affected 26 patients (37.7%). Previous myocardial infarction (MI) was the least prevalent risk factor, affecting only 9 patients (13.1%). In comparison with a study by Heyman et al (2023), acquired factors also include infections, toxins, cancer treatment, endocrinopathies,tachyarrhythmias, and even immune-mediated diseases. Around 5-15 % of the patients in the aforementioned study had acquired DCM and were likely to harbor a pathogenic gene variant [9]. The results of our study differ from the one by Heyman et al due to variations and confounders present in the patient population.
Table 6 in our study indicates that, it was seen that shows that some ECG changes were more prevalent than others, such as ventricular hypertrophy, atrial fibrillation, and intraventricular conduction delay. Ventricular hypertrophy, which means enlargement of the lower chambers of the heart, was observed in 43 patients (62.32%), either in the left, right, or both ventricles. Atrial fibrillation, which means irregular and fast heart rhythm, was observed in 12 patients (17.39%). Intraventricular conduction delay, which means delayed electrical impulses in the lower chambers of the heart, was observed in 20 patients (28.98%). The study by Crescenzi C (2023 May) discusses that the main ECG findings in DCM patients stress that ECG patterns are typical of specific forms of DCM [10].Another studybyTüre and Balık etal (2020) onthe pediatric DCM population highlights the relationship between electrocardiographic data and

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patient outcomes, indicating that there can be a statistically significant difference in terms of various ECG parameters among surviving and exituspatients[11].

Table 7 shows that indicating a reduced pumping ability of the heart. Another study by Kaviarasanet al. (2022) in The Egyptian Heart Journal also discusses the link between reduced ejection fraction and DCM. It states that the most commonly used nomenclature to characterize HF is the left ventricular ejection fraction (LVEF). Those with reduced LVEF (40%) are termed HF with reduced ejection fraction (HFrEF), and it is now classified as a distinct disease[12].

Table 8 of the results indicates that LA size and RV size are significantly associated with the severity of symptoms. This implies that patients with larger LA and RV are more likely to have severe symptoms than those with smaller LA and RV. On the other hand, EF and LVEDD are not significantly associated with the severity of symptoms, with p-values of 0.233 and 0.522, respectively. This means that there is no clear difference in the distribution of EF and LVEDD between patients with severe and mild to moderate symptoms.

Conclusion: -

DCM is a complex condition with a variety of causes and symptoms. The data from our study provides valuable insights into the prevalence of different symptoms and signs in patients with DCM, as well as the most common causes and risk factors.

It’s interesting to note the high prevalence of symptoms like dyspnea and signs like raised Jugular Venous Pressure (JVP) in our study. The comparison of our findings with other studies also provides a broader context for understanding DCM.

The genetic aspect of DCM with mutations in various genes being implicated in both familial and sporadic DCM cases is particularly intriguing. This suggests that further research into the genetic basis of DCM could potentially lead to new approaches for diagnosis and treatment.
In conclusion, the study highlights the prevalence of symptoms such as dyspnea and signs like raised JVP in heart failure patients. The findings align with previous studies, underscoring the commonality of these symptoms. However, the high prevalence of pedal edema contrasts with other studies, suggesting a need for further investigation. The study also reveals a significant association between LA and RV size and symptom severity, but not with EF and LVEDD. The mean ejection fraction was found to be below the normal range, indicating reduced heart pumping ability. This aligns with the characterization of heart failure with reduced ejection fraction (HFrEF) in other studies. The findings contribute valuable insights to the understanding of heart failure symptoms and their associations with various factors. Further research is needed to explore these associations and their implications for patient care.

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