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Original Article

Echocardiographic Analysis of Ischemic Dilated Cardiomyopathy in Bangladeshi Population in BIRDEM – A Retrospective Observational Study

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Abstract:

Background: *Ischaemic dilated cardiomyopathy (IDCM) is a well-recognised consequence of coronary artery disease (CAD), characterised by ischaemia-induced ventricular remodelling, which leads to irreversible myocardial tissue loss and impaired contractility, predominantly affecting left ventricular ejection fraction. In view of the high prevalence of chronic heart failure due to underlying IDCM and the lack of data on IDCM, this study was undertaken.*

Objective: *The objective of this retrospective cross sectional study was done to find out the incidence, severity and echocardiographic findings in patients having Ischaemic Dilated cardiomyopathy.*

Methods: *Retrospective cross sectional observational study was conducted in the Department of Cardiology in BIRDEM General Hospital, Dhaka, Bangladesh which is a tertiary care hospital in Dhaka & attached with Ibrahim Medical College. Secondary data was collected from July, 2020 to June, 2024. All patients who attended Echocardiography room of cardiology department in BIRDEM General Hospital and found to have Echocardiographic findings of IDCM were included in this study. Purposive sampling method was applied as per availability and satisfying the inclusion and exclusion criteria.*

Results: *Fifty eight thousand two hundred and twenty seven (58,227) ecocardiography were done and 663 patients were diagnosed as IDCM. Among them, 440 (66.4%) were male and 223 (33.6%) were female with mean age 57.41 years. Regarding severity of Ejection fraction, most patients were in the range 30-39%, the next was between 20-29% and the lowest was<20%. Regarding echocardiographic parameters in IDCM, dilatation of left ventricle (both LVIDd and LVIDs) was invariably present in almost all patients. Enlargement of LA was found in 61.38% and RV was present in 78.58%. Regarding valvular regurgitation in IDCM, mitral regurgitation was the commonest which was present in 92.8% cases where moderate regurgitation dominating at 54.9%, followed by mild (32.1%) and a smaller but clinically important group with severe involvement (5.7%). Tricuspid regurgitation was present in 76.9% cases, pulmonary regurgitation in 44% cases and aortic regurgitation in 33.3 % cases. The highest proportion of RV dysfunction was recorded in 2024, with 137 out of 196 patients. The majority had no effusion, accounting for 512 patients (77.2%). Mild effusion was observed in 87 patients (13.1%), while moderate effusion was present in 56 patients (8.4%). Severe effusion was the least common finding, seen in only 8 patients (1.2%). The analysis showed that patients older than 50 years had significantly larger chamber dimensions. Right ventricular internal dimension at end-diastole, left ventricular internal diameter at end-diastole, and left ventricular internal diameter at end-systole were all significantly higher in the older group (p=0.025, p=0.042, and p=0.032, respectively).*

Conclusion: *This study identifies the increasing frequency of IDCM, which occurs mainly in the elderly with increased prevalence in men. Incidence of IDCM was 1.13 % over 5 years. The largest population of participants were within age range 40-60 years. Diabetes Mellitus and HTN were common risk factor.*

Key Words: *Ejection fraction (EF), Ischaemic dilated cardiomyopathy (IDCM), BIRDEM, Bangladesh.*

Introduction

Cardiomyopathies are defined as myocardial disorders in which the heart is structurally and functionally abnormal. Morphologically defined subtypes include hypertrophic cardiomyopathy (HCM), dilated cardiomyopathy (IDCM), arrhythmogenic cardiomyopathy, and left ventricular (LV) non compaction cardiomyopathy[1,2]. In 2008 a new classification of the European Society of Cardiology (ESC) went back to the traditional concept of classifying cardiomyopathies based on morpho-functional phenotypic features, thus maintaining the traditional four conditions - "DCM, HCM, RCM and ARVC" - with the addition of the group of "unclassified cardiomyopathies" including "left ventricular non-compaction (LVNC)" and "tako-tsubo" cardiomyopathy[3]. Dilated Cardiomyopathy (DCM) is a disease with a highincidence and has a great social impact on patients [4]. The incidence of DCM is reported to be 5 to 8 cases per 1, 00,000 population per year. It occurs 3 times more frequently in males as compared to females. It is also more common in blacks[5]. Dilated cardiomyopathy is the third most common cause of heart failure and is the commonest type of cardiomyopathy[6]. Ischemic heart disease is the most common cause of dilated cardiomyopathy. Left ventricle is enlarged

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and dilated due to loss of blood supply to the heart muscle as a result of coronary artery disorder[7]. Ischaemic cardiomyopathy (ICM) is a well-recognised consequence of coronary artery disease (CAD), characterised by ischaemia-induced ventricular remodelling, which leads to irreversible myocardial tissue loss and impaired contractility, predominantly affecting left ventricular ejection fraction[8]. The main cause for development of DCM is an ischemic heart disease, which is thought to be responsible for ventricular dilatation in more than 60% of cases of DCM. The diagnostic and therapeutic approaches to ischemic heart disease are well coded, thus allowing effective treatment of patients[9]. Systolic failure is more marked than diastolic dysfunction[10]. In terms of clinical manifestations, ischemic cardiomyopathy (ICM) is similar to DCM, while the difference in treatment is huge[11]. The most common clinical presentation is heart failure, usually left ventricular (LV) failure. The patient can also present with symptoms secondary to arrhythmias, stroke, or sudden death[12]. Among the variety of HF forms, ischaemic cardiomyopathy (ICM) and dilated cardiomyopathy (DCM) are the main causes of chronic HF.[13] In view of the high prevalence of chronic heart failure due to underlying IDCM and the lack of data on IDCM, this study was undertaken. The aim of the study is to find out the incidence, severity and echocardiographic findings in patients having Ischaemic Dilated cardiomyopathy.

Materials And Methods

Retrospective cross sectional observational study was conducted in the Department of Cardiology in BIRDEM General Hospital which is a tertiary care hospital in Dhaka & attached with Ibrahim Medical College. Secondary data was collected from July, 2020 to June,2024. All patients who attended Echocardiography room of cardiology department in BIRDEM General Hospital and found to have Echocardiographic findings of Ischaemic dilated cardiomyopathy were included in this study (July, 2020 to June,2024). and analysed. Purposive sampling method was applied.

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Inclusion criteria*:* Those who had Echocardiographic findings of Ischaemic dilated cardiomyopathy were enrolled in this study.

Exclusion criteria: Normal Ejection fraction, normal cardiac camber, Dilated cardiomyopathy due to other cause.

Echocardiography machine (Vivid E, 95 GE Healthcare, Herten, Norway) was used for the study. After collection, data editing and clearing was done manually and prepared for data entry and analysis.

SPSS (statistical package for social scientists) version 20 were used to analyze the data, Data were presented in tabular and in different graphical presentations, statistical calculations such as mean, standard deviations and appropriate statistical tests were performed**.** 5% alpha level were considered to see the significance of the study.

Results

The patients attended Echocardiography room under Cardiology dept. BIRDEM was the study subject. From July 2020 to June 2024 data had been taken. 58227 echocardiography were done and 663 patients were diagnosed. 440 (66.4%) were male and 223 (33.6%) were female with mean age 57.41 years.

The demographic distribution of the study subject showed about 66.4% are male and rest were female (33.6%) which means male predominant.

Table I: Gender-wise Distribution of the Study Subjects according to Age (N=663)

Age	Gender		
(years)	Male	Female	Total
<20	1 (0.2%)	2 (0.3%)	3 (0.5%)
20-40	26 (3.9%)	38 (5.7%)	64 (9.7%)
40-60	219 (33.0%)	126 (19.0%)	345 (52.0%)
60-80	182 (27.5%)	48 (7.2%)	230 (34.7%)
>80	12 (1.8%)	9 (1.4%)	21 (3.2%)
Total	440 (66.4%)	223 (33.6%)	663 (100.0%)

Table I presents the gender-wise distribution of study subjects across different age groups. The largest proportion of participants fell within the 40–60-year age range, accounting for 345 individuals (52.0%), with males contributing 219 (33.0%) and females 126 (19.0%). The next most represented age group was 60–80 years, comprising 230 patients (34.7%), of whom 182 were male (27.5%) and 48 were female (7.2%). Younger age categories showed markedly lower representation: only 64 participants (9.7%) were between 20–40 years, and just 3 individuals (0.5%) were below 20 years. A total of 21 subjects (3.2%) were over 80 years old. Overall, the study population consisted of 663 patients, with males forming two-thirds (440, 66.4%) and females one-third (223, 33.6%) of the participants.

Table II: Distribution of LVEF

Ejection fraction	Gender		Age	
(%)	Male	Female	<50 Years	>50 Years
<20	24 (3.6%)	12 (1.8%)	10 (1.5%)	26 (3.9%)
20-29	207 (31.2%)	89 (13.4%)	75 (11.3%)	221 (33.3%)
30-39	195 (29.4%)	114 (17.2%)	94 (14.2%)	215 (32.4%)
40-45	14 (2.1%)	8 (1.2%)	10 (1.5%)	12 (1.8%)

Table III: Echocardiographic Parameters in IDCM and Valvular regurgitation in IDCM

Echocardiographic Parameters in IIDCM	Gender		Age	
	Male	Female	<50 Years	>50 Years
LAs (cm)				
<4.0 cm	152 (22.9%)	104 (15.7%)	77 (11.6%)	179 (27.0%)
>4.0 cm	288 (43.4%)	119 (17.9%)	112 (16.9%)	295 (44.5%)
RVIDd (cm)				
<3.0 cm	88 (13.3%)	54 (8.1%)	49 (7.4%)	93 (14.0%)
>3.0 cm	352 (53.1%)	169 (25.5%)	140 (21.1%)	381 (57.5%)
LVIDd (cm)				
<5.6 cm	33 (5.0%)	37 (5.6%)	27 (4.1%)	43 (6.5%)
>5.6 cm	407 (61.4%)	186 (28.1%)	162 (24.4%)	431 (65.0%)
LVIDs (cm)				
<4.0 cm	18 (2.7%)	19 (2.9%)	11 (1.7%)	178 (26.8%)
>4.0 cm	422 (63.7%)	204 (30.8%)	26 (3.9%)	448 (67.6%)
Valvular regurgitation				
Mitral regurgitation				
Absent	13 (2.1%)	6 (0.9%)	6 (0.9%)	13 (2.1%)
Mild	151 (23.8%)	62 (9.8%)	58 (9.1%)	155 (24.4%)
Moderate	231 (36.4%)	133 (21.0%)	103 (16.2%)	261 (41.2%)
Severe	22 (3.5%)	16 (2.5%)	14 (2.2%)	24 (3.8%)
Tricuspid regurgitation				
Absent	45 (7.8%)	19 (3.3%)	14 (2.4%)	50 (8.7%)
Mild	167 (29.1%)	68 (11.8%)	70 (12.2%)	165 (28.7%)
Moderate	147 (25.6%)	88 (15.3%)	64 (11.1%)	171 (29.8%)
Severe	26 (4.5%)	14 (2.4%)	10 (1.7%)	30 (5.2%)
Aortic regurgitation				
Absent	145 (33.6%)	65 (15.0%)	68 (15.7%)	142 (32.9%)
Mild	104 (24.1%)	68 (15.7%)	41 (9.5%)	131 (30.3%)
Moderate	32 (7.4%)	17 (3.9%)	7 (1.6%)	42 (9.7%)
Severe	1 (0.2%)	0 (0.0%)	0 (0.0%)	1 (0.2%)
Pulmonary regurgitation				
Absent	249 (37.6%)	122 (18.4%)	95 (14.3%)	276 (41.6%)
Mild	122 (18.4%)	61 (9.2%)	63 (9.5%)	120 (18.1%)
Moderate	63 (9.5%)	39 (5.9%)	28 (4.2%)	74 (11.2%)
Severe	6 (0.9%)	1 (0.2%)	3 (0.5%)	4 (0.6%)
Diastolic Dysfunction				
Yes	173 (26.1%)	399 (60.2%)	173 (26.1%)	399 (60.2%)
No	16 (2.4%)	75 (11.3%)	16 (2.4%)	75 (11.3%)

The table II showed that the LVEF is much more higher in younger age group that is 20-29 years. Table III brings together the key echocardiographic characteristics of patients with IDCM, showing how chamber dimensions, functional parameters, and valvular regurgitations vary by gender and age. A consistent pattern appears across most variables, like structural enlargement and functional impairment are more common in patients above 50 years, also it is slightly more pronounced in males. Left atrial enlargement (>4.0 cm) was highly prevalent, seen more often in older patients (44.5%) and in men (43.4%). A similar age related condition is noted in left ventricular dimensions. Most individuals with markedly increased LV end-diastolic diameter (LVIDd>5.6 cm) and end-systolic diameter (LVIDs >4.0 cm) were over 50 years old, reflecting progressive remodeling with age. As expected in IDCM, reduced ejection fraction dominated the cohort: the majority fell within the 20–39% range, male 207 (31.2%) and female 89 (13.4%). Right ventricular dysfunction was observed affecting 57.5% of patients above 50 years. Moderate to severe pulmonary hypertension appeared mostly in older individuals. Valvular regurgitation exhibited the classic IDCM pattern, with mitral and tricuspid valves at the greatest burden. Moderate MR and TR were especially common among patients above 50. In contrast, aortic and pulmonary regurgitations were generally mild, severe condition is hardly seen. Diastolic dysfunction showed the most in older patients (60.2%) and represented a major component of the functional impairment in this group. Younger individuals constituted only a small portion of those with diastolic involvement.

Table IV: Valvular regurgitation in IDCM

Parameters	Mitral regurgitation	Tricuspid regurgitation	Aortic regurgitation	Pulmonary regurgitation
Present	615 (92.8)	510 (76.9)	221 (33.3)	292 (44.0)
Mild	213 (32.1)	235 (35.4)	172 (25.9)	183 (27.6)
Moderate	364 (54.9)	235 (35.4)	49 (7.4)	102 (15.4)
Severe	38 (5.7)	40 (6.0)	1 (.2)	7 (1.1)
Absent	48 (7.2)	153 (23.1)	442(66.7)	371(56.0)

Echocardiographic findings revealed severe structural and functional abnormalities of the heart which is seen in table 4. Mitral regurgitation was the commonest where the moderate regurgitation dominating at 54.9%, followed by mild (32.1%) and a smaller but clinically important group with severe involvement (5.7%). Tricuspid regurgitation showed a similar pattern, with mild and moderate forms each present in 35.4% of patients, while severe regurgitation appeared in 6.0%. Aortic regurgitation was far less prominent in this study. Nearly one-third of patients (31.7%) had no aortic regurgitation at all, and the majority of detected cases were mild (25.9%). Only a single patient exhibited severe aortic regurgitation. Pulmonary regurgitation followed same path with more than half of the subjects (56.0%) showing no involvement and only 1.1% falling into the severe category. Altogether, the table illustrates how profoundly IDCM affects the atrioventricular valves which are mitral and tricuspid, while the semilunar valves, especially the aortic valve, remain comparatively spared. This pattern mirrors the chamber remodeling characteristic along with hemodynamic burden of the disease.

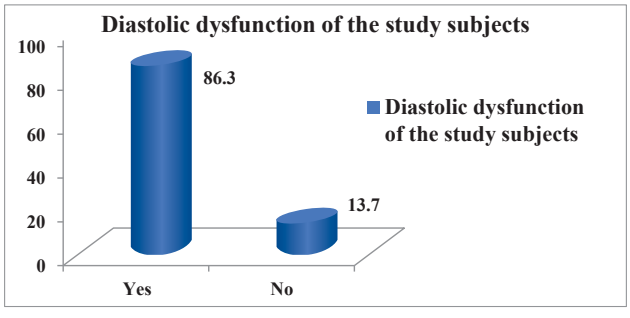

Figure 1: Diastolic dysfunction of the study subjects

Figure 1 illustrates the distribution of diastolic dysfunction among the study subjects. A large majority of patients demonstrated evidence of diastolic dysfunction, accounting for 86.3% of the participants. Only 13.7% of individuals showed no signs of diastolic impairment. The visual contrast between the two bars highlights the prominent burden of diastolic dysfunction in patients with ischemic dilated cardiomyopathy.

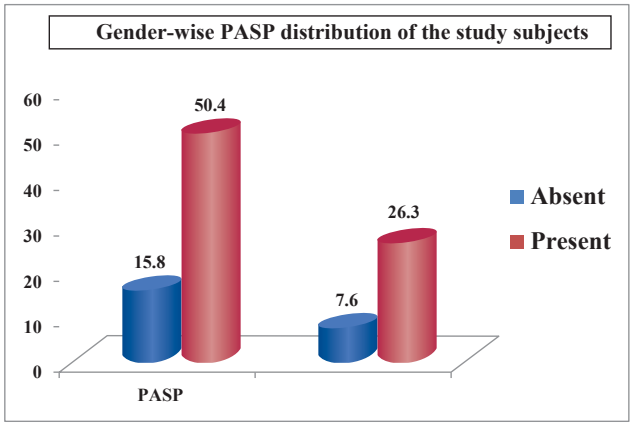

Figure 2: Gender-wise PASP distribution of the study subjects.

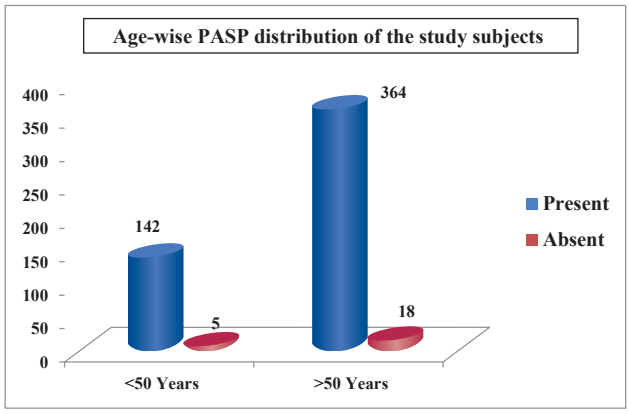

Figure 3: Age-wise PASP distribution of the study subjects

Table V: Independent Sample t Test

Variables	Mean±SD	P Value	95% Confidence Interval
Left Atrial Strain (LAs)	4.07±0.55	0.625	-.146-.040
Right ventricular internal dimension at end-diastole	2.57±1.21	0.025*	-.132-.400
Left ventricular internal diameter at end-diastole	6.08±0.67	0.042*	-.185-.041
Left ventricular internal diameter at end-systole	5.46±3.92	0.032*	-.697-.196
LVEF	30.15±6.43	0.113*	-.654-1.521
Pulmonary artery systolic pressure	53.04±18.88	0.285	-2.150-5.054

The independent sample t-test results presented in table V compare key echocardiographic parameters across age groups. The analysis shows that patients older than 50 years had significantly larger chamber dimensions. Right ventricular internal dimension at end-diastole, left ventricular internal diameter at end-diastole, and left ventricular internal diameter at end-systole were all significantly higher in the older group (p=0.025, p=0.042, and p=0.032, respectively). These findings reflect the progressive structural remodeling that accompanies advancing age in patients with IDCM. Other variables which include left atrial strain, left ventricular ejection fraction, and pulmonary artery systolic pressure, did not show statistically significant differences between age groups.

The distribution of pericardial effusion among 663 patients showed majority had no effusion, accounting for 512 patients (77.2%). Mild effusion was observed in 87 patients (13.1%), while moderate effusion was present in 56 patients (8.4%). Severe effusion was the least common finding, seen in only 8 patients (1.2%). Overall, most patients were free from pericardial effusion, with only a small proportion exhibiting mild to severe levels.

Discussion

A study conducted by a Chandan Gantayat et al in South Odisha, India[14] showed most of the study population was within the group 51-60 years, but in our study we classified the group 40-60 years and most of our study subjects was within the group. Similar finding was the gender distribution, that was in that study[14] it was male predominant (71%) and which might compare with our study (66.4%).

In a study by Venkata Harish et al in Department of General Medicine of Sri Venkateswara Ramnarayan Ruia Government General Hospital (SVRRGGH), a major government healthcare facility in Tirupati, Andhra Pradesh showed the study population consisted mainly of males (63%) aged 53.2 years on average, similar result we found consisted mainly of males (66.4%) aged 54.2 years. Echocardiography showed in the mentioned study left ventricular dilatation (mean LVIDd: 60.81 mm) with decreased ejection fraction (mean EF: 28.6%) in our study we revealed left ventricular dilatation (mean LVIDd: 60.08 mm) with decreased ejection fraction (mean EF: 29.88%)[15].

Of 6,145 identified articles, 10 unique studies were included in a review[16]. Six studies reported prevalence, and five studies reported incidence of DCM in various populations. Annual incidence rate of DCM in adult/heterogeneous populations ranged from 6.0 to 7.0 per 100,000 persons. Annual incidence of DCM due toidiopathic/non-idiopathic causes among pediatric populations was reported as 0.6 per 100,000 persons. In our adult study we found the incidence rate was 1.7%.

In a study by Raj Kumar Thapa et al in Nepal[17] showed 65 patients enrolled 40 (61%) were male and 25 (39%) were female with male to female ratio of 1.6:1. Elderly people (61-75 years) with an average age of 65 were commonly involved andthey presented mostly with congestive heart failure, 32 (49%). Echocardiographic evaluation showed 36 (55%) with mildly dilated Left Ventricle (5.6-6.0cm). Majority had reduced Left ventricular systolic function with an average Ejection fraction (EF) of 39.6%. In our study we found male to female ratio of 1.9:1. In our study result Echocardiographic evaluation showed 33 (5.0%) male and 37 (5.6%) female with mildly dilated Left Ventricle (5.6-6.0cm). Majority had reduced Left ventricular systolic function with an average Ejection fraction (EF) of 28.6% which contrast with the mentioned study.

One hundred patients from a tertiary care center participated in a study on the clinical, electrocardiographic, and echocardiographic profile of ischemic cardiomyopathy[18]. The mean age of population was 61.4 ± 7.9 years, with a significant male predominance (79%). Forty-three percent of the patients had advanced heart failure (NYHA class IV). Prior ischemic events were prevalent; 64% had experienced an anterior myocardial infarction, 25% had had PTCA, and 7% had had CABG. Sinus tachycardia (71%), atrial fibrillation (15%), LBBB (34%), RBBB (12%), and pathological Q waves were among the common electrocardiographic abnormalities. Significant ventricular dilatation (mean LVIDd 6.5 ± 0.4 cm), regional or global wall

motion abnormalities, different grades of mitral regurgitation, and marked left ventricular systolic dysfunction (mean ejection fraction of 31 ± 5.9%) were all found by echocardiography. The authors came to the conclusion that anterior myocardial infarction frequently preceded ischemic cardiomyopathy and that clinical severity was strongly correlated with the degree of left ventricular dysfunction and dilatation.

Conclusion

This study identifies the increasing frequency of IDCM day by day, which occurs mainly in the elderly with increased prevalence in men. In this study we observed that incidence of IDCM was 1.13% over 5 years. Among them 52% were male and 33% were female. The largest population of participants were within age range 40-60 years. Ejection fraction 30-39% was most frequent. Among valvular regurgitations, Mitral and tricuspid regurgitation was most frequent. RV dysfunction was present in most of the cases. Diastolic dysfunction was also very common. Regarding pericardial effusion, it was not present in most of the cases.

Limitations

This study had several limitations. First, it was an observational, non-randomised study and subject to limitations inherent to any retrospective study. Second, inter-observer variation may be present in taking echo measurement. Third, only echocardiography is not sufficient for diagnosis of IDCM. Other investigations like coronary angiogram, Cardiac MRI was not done. Finally, it was a single institutional study.

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