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Electrocardiographic changes in patients with dilated cardiomyopathy

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Introduction: Cardiomyopathy is the disease of the heart muscle, which causes deterioration of myocardial functioning. A study was conducted to find electrocardiographic findings in dilated cardiomyopathy. **Materials and methods:** This was a hospital-based study, conducted in the department of General Medicine, GSL Medical College. Informed written consent was taken from each patient or his/her attendant prior to including in the study. Patients with dilated cardiomyopathy, both gender, all ages. Heart failure based on Framingham criteria, ECHO criteria – LV ejection fraction less than 45%, with left ventricular or biventricular dilatation, with global hypo-contractility were included in the study. ECG and 2 D Echo have been performed on the patients. Framingham criteria were used for the diagnosis of heart failure. Descriptive statistics were presented in the form of mean ± standard deviation and percentages. **Results:** Total 102 patients were included in the study, with a mean age of 56.3 ±12.5 years, the male-female ratio was 1.9. Tachycardia was 61%, left axis deviation was present 34.3% and right axis deviation in 8.8%. Left ventricular end-diastolic and systolic diameters were elevated in most of the patients. **Conclusion:** With these findings, it can be concluded severe LV systolic dysfunction is very common among dilated cardiomyopathy patients.

Keywords: Cardiomyopathy, Dilated, Dysfunction, Patient

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Introduction

Cardiomyopathy is the disease of the heart muscle, which causes deterioration of myocardial functioning. This is a complex disease process that can affect the heart of a person of any age, and clinical manifestations appear most commonly in the 3rd and 4th decade. Dilated cardiomyopathy (DCM) is the most common type of cardiomyopathy worldwide [1,2].

DCM is a disease of the heart muscle, primarily affecting the left ventricle and characterized by ventricular dilatation, impaired systolic function, and reduced myocardial contractility [3]. The diagnosis of DCM requires evidence of dilation and impaired contraction of the left ventricle or both ventricles [4].

There are various causes of this disease including genetic, autoimmune, infiltrative or infective causes [2]. In many cases, despite investigations, the cause remains unknown. Affected patients have impaired systolic function and may or may not develop overt heart failure.DCM is the leading indication for heart transplantation in both adults and children in the West [5,6].

DCM is an important cause for emergency room visits in our country. DCM is a relatively common cause of heart failure, with a prevalence rate of 0.04% and incidence is 5 to 8 cases per 100,000 of population per year, increasing steadily [7-9]. In one study, the prevalence in adults was found to be 1 in 2500 [10]. The incidence of the disease has been reported to vary from region to region and among ethnic groups.

However, the true figure is likely to be higher as a consequence of under-reporting of mild asymptomatic cases [11,12], and the incidence varies according to the gender and ethnic background. In adults, DCM arises more commonly in men than in women and the incidence is higher in black people than in white people.

Electrocardiogram and Echocardiography are essential tools for the evaluation of patients with DCM. The prevalence of electrocardiographic abnormalities in DCM is high, averaging 83% [13]. Cardiac arrhythmias and ECG abnormalities are an important cause of decompensation to heart failure in patients with DCM in addition to increased morbidity, for instance, cardio-embolic stroke in atrial fibrillation and the presence of left ventricular thrombus.

Currently, there is the paucity of data on DCM in India. With these, the study was conducted to find electrocardiographic findings in DCM.

Materials and Methods

Study design: This was a hospital-based study, conducted in the department of General Medicine, GSL Medical College.

Study subjects: Type 2 diabetic subjects who attended the outpatient and inpatient wards of medicine department in GSL medical college were included in the study.

Sample size: Random sampling was considered in the study.

Study period: Study was conducted from November 2014 to April 2016.

Inclusion criteria: Patients with DCM, both gender, all ages. Heart failure based on Framingham criteria, ECHO criteria –LV ejection fraction less than 45%, with left ventricular or biventricular dilatation, with global hypo-contractility were included in the study.

Exclusion criteria: Patients with pericardial disease, valvular heart disease, congenital heart disease, corpulmonale with CHF, hypertrophic cardiomyopathy, restrictive cardiomyopathy, systemic hypertension and confirmed ischemic heart disease were excluded.

The detailed history and physical examination findings were noted. History suggestive of congenital, rheumatic heart disease was enquired from each patient and excluded. All patients of DCM were subjected to ECG and two-dimensional Echocardiography (2D Echo) with color doppler. ECG and 2 D Echo have been performed on the patients by using standard methods. Framingham criteria were used for the diagnosis of heart failure [14].

Statistical analysis: All the descriptive statistics were presented in the form of mean ± standard deviation and percentages. These were performed using statistical package for social sciences (SPSS) 20 software version and MS EXCEL-2007.

Results

A total of 102 patients were included in the study, with a mean age of 56.3 ± 12.5 years. Age-wise, 2% (2) were included in 21-30 years group, 8.8% (9) included in 31-40 years group, 23.5% (24) in

41-50 years group, 26.5% (27) in 51-60 years group, 29.4% (30) in 61-70 years group and 9.8% (10) in >71 years group (Table 1).

Gender wise, 65.7% (67) were male members and 34.3% (35) were female members in this study. The male-female ratio was 1.9 (Table 2).

Tachycardia was 61%, left axis deviation was present 34.3% and right axis deviation in 8.8%. Left ventricular end-diastolic and systolic diameters were elevated in most of the patients.

Table-1: Age-wise distribution of study participants

Age in years	Number	%
≤20	0	0
21-30	2	2
31-40	9	8.8
41-50	24	23.5
51-60	27	26.5
61-70	30	29.4
≥71	10	9.8
Total	102	100

Table-2: Gender wise distribution of study participants

Gender	Number	%
Male	67	65.7
Female	35	34.3
Total	102	100

Table-3: Comparison of QRS Axis among the study members.

Parameter	Number	%
Left axis deviation	35	34.3
Right axis deviation	9	8.8

Discussion

Cardiomyopathies are either confined to the heart or are part of generalized systemic disorders, often leading to cardiovascular death or progressive heart failure-related disability [15]. Cardiomyopathies are divided into two major groups based on predominant organ involvement: Primary cardiomyopathies and secondary cardiomyopathies.

Primary cardiomyopathies (genetic, nongenetic, acquired) are those solely or predominantly confined to the heart muscle and are relatively few in number. Secondary cardiomyopathies show pathologic myocardial involvement as part of a large number and variety of generalized systemic (multiorgan) disorders.

The systemic diseases associated with secondary forms of cardiomyopathies have previously been referred to as specific cardiomyopathies or specific heart muscle diseases in prior classifications [4,16]. The frequency and degree of secondary myocardial involvement vary considerably among cardiomyopathies, some of which are exceedingly uncommon, and for which the evidence of myocardial pathology may be sparse and reported in only a few patients.

DCM spares no age. The middle age group is more commonly affected. The present study also reflected the same. Out of the 102 patients included in the study, 50% of patients were between the age of 41-60 years with a mean age of 56.3. In one study by Rudrajitet al [17], most of the patients were aged over 40 years.

50% of the patients were 60 years or older with the mean age of 54.4±16.2 years. Similarly, in the study conducted by Himanshu Ranaet al. [18], two-thirds of the patients are from the 40 plus age group. Whereas the mean age was reported to be 41.7±16.5 years by Das et al [19].

DCM, the most common form of cardiomyopathy is characterized by ventricular chamber enlargement and systolic dysfunction. DCM leads to progressive heart failure and a decline in LV contractile function, ventricular and supraventricular arrhythmias, conduction system abnormalities, thromboembolism, and sudden or heart failure-related death.

The natural history of the clinical syndrome of heart failure depends on the course of myocardial failure because (1) the most powerful single predictor of outcome is the degree of left ventricular (LV) dysfunction as assessed by the LV ejection fraction [20] (2) treatment that improves intrinsic ventricular function improves the natural history of heart failure [21,22] and (3) treatment that ultimately worsens intrinsic function, such as many types of positive inotropic agents, is associated with an adverse effect on outcome.

DCM is a common and largely irreversible form of heart muscle disease with an estimated prevalence of 1:2500 persons and is the third most common cause of heart failure and the most frequent indication of heart transplantation [10]. DCM may manifest clinically at a wide range of ages (most commonly in the third or fourth decade, but also in young children).

DCM can occur in an idiopathic form or secondary to other cardiac or systemic diseases. The idiopathic form may represent sequelae of remote episodes of viral myocarditis. Autoimmunity has also been implicated as the underlying mechanism in idiopathic DCM. Familial or genetic causes may account for 20-48% of the etiologies [10].

Mutations in a large number of genes have been implicated. Although all modes of inheritance occur, the most common is autosomal dominant with incomplete penetrance. Mutations in the gene encoding titin are the commonest and other common mutations responsible for an autosomal dominant pattern occur in myosin heavy chain (MYH7), Cardiac troponin Tand lamin A/C genes. The second most common mode of inheritance is X-linked and the gene most commonly responsible is the dystrophin gene.

Secondary causes include Endocrine disorders (hypothyroidism/ hyperthyroidism, phaeochromocytoma, Cushing's disease, diabetes mellitus, growth hormone abnormalities), nutritional deficiencies (thiamine, carnitine, selenium), metabolic disturbances (uremia, hypocalcemia, hypophosphatemia), toxins (ethanol, antiretroviral agents, anthracyclines, radiation, cocaine, heavy metals like cobalt, lead, mercury).

DCM was reported to be more among males as per the available reports [19,23]. The present study also reflected similar findings. This male preponderance was explained as male hormones and lifestyle-related changes may predispose to cardiac muscle dysfunction and alteration of cardiomyocyte membrane functions. However, there are also a few studies where this male predominance has not been found. In the study by Coughlin S Set al [24] comparing DCM in blacks and whites in the USA, they have found that in the black subset, the male-female ratio was almost equal.

Given their non-invasive nature, ECG is the first test completed with any suspicion of an underlying disease. ECG findings vary for each patient in DCM. Sinus tachycardia is often seen when heart failure is present. Some patients may be devoid of abnormalities while others may have isolated T wave changes, septal Q waves due to extensive fibrotic damage, prolonged atrioventricular conduction, bundle branch blocks, and/or atrial or ventricular tachyarrhythmias [25].

ECG findings in DCM patients were usually abnormal; however, it may be remarkably normal. The structural heart disease associated with dilatation and remodeling of the cardiac chambers, myocardial fibrosis with loss of cell to cell coupling present in patients with DCM all alter electrophysiological properties accounting for the observed high prevalence of ECG abnormalities.

ECG in DCM is a nonspecific but sensitive tool which may be related to different degrees of myocardial impairment and may be useful in the definition of a prognostic profile. The present study showed regular rhythm in 71.6% of patients and irregular rhythm in 24.4%. These findings were similar to studies conducted by Rudrajit et al [17] and Naruttam Sonowal et al [26].

Himanshu M Rana et al [27] observed sinus tachycardia in a higher number of patients (63.33%) compared to the present study and also sinus bradycardia was present in 1.66% of patients in this study. Echocardiography has a unique role in accurately defining the condition, establishing the diagnosis in patients presenting with heart failure. Different echocardiographic findings were found in DCM patients.

ECG findings included LV dilatation, reduced EF and global hypokinesia in all patients. In the present study, the majority of the patients had severe LV systolic dysfunction with a mean ejection fraction of 30.8 ± 6.7%. The LV ejection fraction was severely impaired (EF<30%) in 49% of patients. Moderate LV dysfunction (EF 31-40%) was present in 40.2% and mild LV dysfunction (EF≥41%) was present in 10.8%. These results were in correlation with other studies.

In the study by Ganesh et al [28] majority (58%) of the patients had severe LV systolic dysfunction (EF<30%). In the study by Himanshu M Rana et al [29] 75.48% had severe LV systolic dysfunction (EF<30%). In the study by Saumen Nandi et al [23] 38% of the patients had ejection fraction <30% and 61.9% were with EF between 30-50%.

Limitation

Small sample size, short duration are the limitations of the study.

Conclusion

With these findings, it can be concluded that severe LV systolic dysfunction is very common among DCM patients.

What does the study add to the existing knowledge

LV systolic dysfunction is very common among DCM patients. DCM is common among the male and common in 56-60 years age group.

Author's Contribution

Dr. Vietla Sreeramulu: Study design, Literature survey, data analysis, paper writing. **Dr. Ch Veerendra Ravi Kiran:** Study design, paper writing. **Dr. Dharnesh Babu D:** Main work, Literature survey, data analysis. **Dr. T Jaya Chandra:** Data analysis, paper writing, statistical part.

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