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# Clinical and Doppler Study of Restrictive Filling Pattern in Patients with Dilated Cardiomyopathy

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***Background:*** Dilated cardiomyopathy (DCM) is a well-recognized cause of cardiovascular morbidity and mortality.
***Objectives:*** To evaluate the prognostic implications of the restrictive left ventricular filling pattern (RFP) in dilated cardiomyopathy.
***Methods:*** Patients with DCM admitted to Ibn AL-Bitar Hospital for Cardiac Surgery, Baghdad-Iraq, from May 2006 to August 2008, underwent a full clinical evaluation and Doppler echocardiography study. Patients were classified into three groups: Group I had persistent restrictive filling pattern; Group II had reversible restrictive filling pattern; and Group III had nonrestrictive filling pattern.
***Results:*** The current study was conducted on a total number of 80 patients with DCM, fifty (62.5 %) were males and 30(37.5%) were females with a male to female ratio 1.6:1. Patients with restrictive filling pattern (Group I&II) were 51 (63.8%), while patients with nonrestrictive filling pattern (Group III) were 29 (36.2%). During follow up, patients with persistent restrictive filling pattern (30; 37.5%) had higher New York Heart Association (NYHA) class symptoms, low ejection fraction (EF) and higher mortality; 6 (20%) died within the first year, 6 (20%) died in the second year. Clinical improvement was significantly frequent in Group II and III than Group I.
***Conclusions:*** In patients with DCM, the persistence of restrictive filling at 3 months is associated with a high mortality the patients with reversible restrictive filling have a high probability of improvement and excellent survival.

## Introduction:

Dilated cardiomyopathy (DCM) is a syndrome characterized by cardiac enlargement and impaired systolic function of one or both ventricles [(1)].

Blacks and males have a 2.5-fold increase in risk, as compared with whites and females [(2)]. It is likely that this condition represents a final common pathway that is the end result of myocardial damage produced by a variety of cytotoxic, metabolic, immunological, familial, and infection mechanisms. About 20-30% of dilated cardiomyopathy cases have been reported as familial [(3-5)].

The chief morphologic feature of DCM is dilatation of both ventricles. The heart is increased in weight, indicating hypertrophy, but the maximal thickness of the left ventricular free wall and septum are typically normal because of the abnormally dilated chambers [(6-8)].

Patient presentation can range from asymptomatic left ventricular dysfunction to mild, moderate, or severe congestive heart failure. Symptoms of left-sided heart failure predominate, with diminished exercise capacity, progressive exertional dyspnea, and eventually orthopnea and paroxysmal nocturnal dyspnea. Dilated cardiomyopathy is characterized by a dilated poorly functional left ventricle [(9-11)].

Dilated cardiac chambers characterized advanced stages of dilated cardiomyopathy, predominately the left ventricle, associated with accompanying systolic dysfunction [(6)].

Patient with dilated cardiomyopathy frequently exhibit some degree of diastolic dysfunction. A restrictive Doppler pattern has been associated with worse prognosis in patients with heart failure. Mitral deceleration time (DT) less than 140 ms is associated with poor prognosis [(12-14)].

The present study is planned to evaluate the prognostic implications of the restrictive left ventricular filling pattern in dilated cardiomyopathy.

## Methods:

From May 2006 to August 2008, patients with DCM underwent thorough clinical evaluation and were studied by Doppler echocardiography in Ibn AL-Bitar Hospital for Cardiac Surgery, Baghdad, Iraq.

At the time of entry to study, patients' previous and current medical history, current medications, symptoms and physical examination findings were recorded. Baseline variables included New York Heart Association functional class (NYHA), routine blood chemistry, chest X-ray (CXR) and 12-lead electrocardiogram (ECG).

Patients were scheduled for regular clinical follow-up evaluations after 3 months, one year and two years in our cardiac center. Follow-up information was also obtained by either direct interview at the hospital or by trans-telephonic.

Transthoracic echocardiograms were obtained using a commercially available sector scanner 2.5-MHz transducer. Two-dimensional echocardiograms and Doppler tracings of mitral inflow were recorded and analyzed. Left atrial size, left ventricular end-diastolic diameter (LVEDD), left ventricular end-systolic dimensions and Left ventricular ejection fraction were measured from M-mode tracings of parasternal long- and short-axis views.

Transmitral flow velocity tracings were obtained by pulsed wave Doppler echocardiography from apical four-chamber views, with the Doppler sample volume positioned at the tips of the mitral leaflets where color flow indicated maximal flow. From mitral inflow patterns, we derived peak velocity of early (E) and late (A) diastolic filling wave, their E/A ratio and deceleration time (DT) of early inflow, defined as the slope from peak E extrapolated to the baseline value.

Primarily, patients in sinus rhythm were assigned into two groups according to the presence of restrictive and nonrestrictive diastolic filling patterns. Restrictive mitral inflow patterns were defined as an E/A ratio either ≥2 or 1-2, with DT≤140ms. Accordingly, nonrestrictive filling patterns were characterized by an E/A ratio of either ≤1 or 1 to 2, with DT>140ms [15]. Further classification of patients with restrictive diastolic filling patterns was done during follow up as to reversible or persistent groups.

The same pulsed Doppler used for determining mitral inflow can be used to determine the pattern of pulmonary vein flow into the left atrium.

Routine left and right coronary angiography and left ventricular angiography was performed from the standard femoral approach in most of patients with two or more risk factors for CAD like hypertension, diabetes hypercholesterolemia, prior CAD, premature deaths in family, smoking and alcohol consumption.

Data were presented in simple measures of frequency, percentage, mean and standard deviation, with statistical significance of various parameters was tested by Chi-square test for testing the significance of difference between proportions (for the qualitative variables), and paired t-test for testing the significance of difference between two dependent means, and t-test for two independent means for the quantitative variables. P value of less than 0.05 was used as the level of significance.

## Results:

Eighty patients with DCM were included in the present study. The mean age of patients was 44.88±9.9 years (ranging from 20 to 70 years) with the majority of patients from fifth decade followed by sixth decade.

Fifty (62.5 %) were males and 30 (37.5%) were females with a male to female ratio 1.6; 1. Most of these patients were symptomatic (75; 93.7%); majority of them complaining of dyspnea (27; 36%), palpitation (17; 22.6%), and chest pain (15; 20%); while the rest (5; 6.3%) were asymptomatic.

During the follow up period, patients with DCM were divided into three categories; Group I persistent restrictive were 30 (37.5%), Group II reversible restrictive were 21 (26.2%) and Group III nonrestrictive were 29 (36.2%).

DCM associated with ischemia in 33 patients (41.2 %), most of whom had left anterior descending artery (LAD) lesions (12; 36.3%), Left circumflex artery (LCX) lesions (9; 27.2%), right coronary artery (RCA) lesions (8; 24.2%) and left main stem lesion(4;12%).

Among patients with ischemic DCM, 21 had RFP (63.6%); 13 (39.4%) had persistent and 8(24.2%) had reversible RFP, while 12(36.3%) had non RFP.

In non-ischemic DCM patients (47; 58.7%), RFP was observed in 30(58.8%) patients, among whom 17 (56.6%) were persistent and 13 (43.3 %) were reversible, while non RFP were 17 (36%).

During follow up, patients with persistent filling pattern had higher NYHA class symptoms and higher mortality; 6 (20%) died within the first year, 6 (20%) died in the second year (table 1), as well as low EF (table 2 & 3).

Table1: NYHA class and mortality in DCM patient groups.

| Variables | | DCM Patient Groups | | | P value |
|---|---|---|---|---|---|
| | | Group I No. (%) | Group II No. (%) | Group III No. (%) | |
| NYHA class symptoms | 1 | 0(0) | 2(9.5) | 15(51.7) | 0.001 |
| | 2 | 3(10) | 15(71.5) | 11(37.9) | |
| | 3 | 9(30) | 4(19) | 3(10.4) | |
| | 4 | 18(60) | 0(0) | 0(0) | |
| Follow up Status | Alive | 18(60) | 21(100) | 29(100) | 0.05 |
| | One year died | 6(20) | 0(0) | 0(0) | |
| | Two years died | 6(20) | 0(0) | 0(0) | |

Table 2: follow up of Ejection Fraction in DCM patient groups.

| Ejection Fraction | DCM Patient Groups | | |
|---|---|---|---|
| | Group I (Mean±SD) | Group II (Mean±SD) | Group III (Mean±SD) |
| Baseline | 25.93±2.48 | 28.33±1.77 | 32.97±3.77 |
| After 3 months | 24.07±2.99 | 30.24±2.17 | 34.90±3.71 |
| After 1 year | 23.21±2.13 | 32.52±2.80 | 36.93±3.98 |
| After 2 years | 22.89±3.05 | 34.14±3.18 | 39.00±3.99 |

## Discussion:

Previous work has demonstrated the importance of the assessment of diastolic function and LV filling in patients with DCM [16]. From a clinical standpoint, in patients with heart failure, dyspnea and functional impairment mainly depend on an increase of LV filling pressure, whereas exercise intolerance is more related to diastolic than systolic function. These data were confirmed more recently by several studies using Doppler echocardiography [17],

Appleton et al., defined the RFP of the Transmittal Doppler curve, characterized by a shortened DT and frequently by a predominant E wave. The RFP can be considered a useful noninvasive sign of increased LV stiffness, as recently confirmed by experimental data [18].

The present study confirms previous investigations which indicate that the RFP is common in DCM, particularly in patients with more severe clinical and hemodynamic abnormalities, and must be considered as a powerful independent adverse prognostic factor [19].

A significant relation between LV filling patterns and the clinical course of DCM was noticed by Werner et al. [20]. A filling pattern with a predominant E wave (presumably restrictive) was more frequent in symptomatic heart failure

patients than in stable patients with a longer duration of the disease [21]. Moreover, during follow up, an increase in the A wave velocity and a decrease in the E wave and E/A ratio were noted in patients who showed clinical improvement, whereas opposite changes were present in those patients who deteriorated. Similar data were described by Shen et al., associated with a prolongation of the DT [22].

Our study shows that RFP is common and is associated with poor outcome in patients with non-ischemic DCM; similar results have been reported by other authors [23]. Furthermore, our results demonstrate differences between two distinct groups of patients according to their filling pattern; DCM patients with RFP had more symptoms as compared to non-RFP patients. This is in agreement with other authors' observations [24].

Noteworthy, in Group I patients, the RFP persisted despite drug treatment, in these patients, presumably, the disease was more severe or progressive. As suggested by Bortone et al., more severe structural myocardial abnormalities, such as fibrosis, were hypothesized [25].

Our study demonstrates that in patients with DCM the Doppler echocardiographic assessment of the evolution of LV filling during medical therapy is clinically helpful in predicting subsequent prognosis and might be used in conjunction with the clinical assessment to select patients for a stricter follow up.

## Conclusions:

Patients with persistent RFP had poor prognosis as the mortality was higher; higher NYHA class (III-VI); low EF; those with reversible RFP and non RFP had good prognosis as they may improve in the first and second year both clinically and hemodynamically.

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