

# Involvement of Right Ventricle Function in Children with Dilated Cardiomyopathy

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ABSTRACT

The study was designed to evaluate the involvement of right ventricular function in children with dilated cardiomyopathy (DCMP) through echocardiographic parameters.

## INTRODUCTION

Right ventricle involvement is frequent in pediatric dilated cardiomyopathy and is associated with worse parameters like left ventricular dimensions, ejection fraction and vacuolar involvement. Now there is growing interest regarding the clinical relevance of RV functional assessment in the heart failure population .Hence, this study was designed to estimate the incidence of RV dysfunction by different echocardiographic parameters in children with dilated cardiomyopathy (non-ischemic).

## METHODS

A cross sectional observational study with consecutive sampling was conduct in the department of Cardiology, CH&ICH, Lahore from October 2019 for 6 months after approval from ethical committee. Data collected by performing echocardiography-using Performa by pediatric cardiologist. All the data was entering in SPSS-22 and then analyzed for statistically significant outcomes. The chi-square test used to measure the association among the different categorical variables.

## RESULTS

48 children of diagnosed case of DCMP were selected. Male were 50% .Out of 48 children 10 patients presented with mild LV systolic dysfunction,13 patients with moderate LV systolic dysfunction while 25 patients presented with severe LV systolic dysfunction. 19 patients showed RV dysfunction ie 39.6%, 36 patients showed septal paradox, 30 patients were with normal RV diastolic function and 18 were presented with RV diastolic dysfunction.

## CONCLUSION

Dilated cardiomyopathy is primary disease of LV, however certain patients presented with sign and symptoms of right heart failure resulting from RV dysfunction. There was significant

involvement of RV dysfunction found ie 39%. Echocardiography helps in the detection of RV involvement in DCMP.

**KEY WORDS:** Heart echocardiography, findings on echocardiography, Children Hospital and Institute of Child Health Lahore.

## INTRODUCTION

Dilated cardiomyopathy (DCM) is the second most frequent cause of heart failure (HF). Despite recent changes in diagnosis and treatment of HF, prediction of prognosis remains uncertain from one patient to another [1], [2]. The effect of left ventricular (LV) function on out come in HF has been well documented [3], [4]. Right ventricular (RV) performance is connected to LV dysfunction in multiple ways (shared fibers and septal wall, biventricular cardio myopathic process, increased LV filling pressures, ventricular interdependence and inextensible pericardial space) [5], [6]. Evaluation of RV performance remains challenging in routine practice and, as a result, RV function has long been neglected [7] Progress in echocardiography has helped to redefine the importance of RV evaluation for further risk stratification [8], [9]. The prevalence of RV dysfunction in DCM varies from 34 to 65% [10].

Currently cardiac MRI is considered to be gold standard for assessment of RV function, but in children it is highly technician dependent along with anesthesia issues especially in case of DCMP with heart failure. Therefore, we planned this study to estimate the effectiveness and incidence of RV dysfunction in children with dilated cardiomyopathy (non-ischemic) by selecting echocardiography parameters most representative of RV functions.

## MATERIALS AND METHODS

Cross sectional study with Consecutive sampling planed .Data collected from Cardiology Department of Children Hospital Lahore and the Institute of Child health for 6 months from October 2019 onward after approval from ethical committee through close-ended Performa. Only patients labeled DCMP

after pediatric cardiologist confirmation on echocardiography selected in the study after parents' consent. Children up to 16 years were selected. Those patients having dysfunctioning LV associated with other diseases like connective tissue disorder, hypertension, ischemic heart disease, Rheumatic heart disease or congenital heart disease were excluded from the study.

**Echocardiographic assessment**

Transthoracic echocardiography done in study children's labeled DCMP through GE-95 machine by consultant pediatric cardiologist. DCM was diagnosed based on the presence of echocardiographic findings of a dilated left ventricle according to age, increased left ventricular dimensions, reduced left ventricular ejection fraction, and reduced fraction shortening. Diastolic function analysis based on mitral-pulsed Doppler inflow and tissue-Doppler imaging at the lateral mitral annulus. A restrictive pattern was define as E-wave deceleration time (DT) < 145 ms .TAPSE was measured by M-mode, after two-dimensional echocardiography guidance at the lateral tricuspid annulus, as the maximal systolic excursion. Tissue Doppler imaging at the tricuspid annular free wall allowed the assessment of S-wave velocity. The variables used for systolic and diastolic dysfunction included for RV were TAPSE, E 'for free wall and septum, A-waves and E-waves, E/A ratio, E|E'. Similarly LV systolic and diastolic function also taken by MAPSE, E 'for LV free wall and septum, A-waves, E-waves, E/A, E|E'.

**Statistical analysis**

All data entered in SPSS-22 and then analyzed for statistically significant outcomes. The chi-square test used to measure the association among the different categorical variables.

**RESULTS**

48 children of diagnosed case of DCMP were selected. LV systolic dysfunction was graded as mild (LVEF 41–45%), moderate (LVEF 36–40%), or severe (LVEF ≤ 35%). From these 20.8% had mild LV dysfunction, 27.1% had moderate LV dysfunction and 52% had severe LV dysfunction (Figure-1). The normal range of LV diastolic function in Mitral annular plane systolic excursion (MAPSE) was .75 to 1.5 and out of 48 patients, 22 were included in this normal range. The dysfunctioning range was less than .75 and greater than 1.5 and patients under this range were 26 patients ie 54% (Table 1). Male were 50%.

**Table 1:** Represented relation of LV diastolic function with LV systolic dysfunction

		LV Systolic dysfunction			Total
		Mild	Moderate	Severe	
LV diastolic function in mm?		4	5	13	22
	<.75and>1.5(dysfunctioning)	6	8	12	26

Total	10	13	25	48
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19 patients showed involvement of RV systolic dysfunction is 39.6% out of which 73.68% children belong to severe LV dysfunctioning group (Table-2).

**Table -2:** Represented RV systolic dysfunction relation with LV systolic Dysfunction

		LV Systolic dysfunction			Total
		Mild	Moderate	Severe	
RV dysfunction	Yes	1	4	14	19
	No	9	9	11	29
Total		10	13	25	48

Out of 48 cases of DCMP 37.5%, children also showed RV diastolic dysfunction out of which 38.8% belong to severe LV dysfunctioning group children (Table-3).

**Table -3:** Represented relation of RV diastolic function with LV systolic dysfunction

		LV Systolic dysfunction			Total
		Mild	Moderate	Severe	
RV diastolic function in mm?	.75 to 1.5(normal)	5	7	18	30
	<.75and >1.5(dysfunctioning)	5	6	7	18
Total		10	13	25	48

36 patients showed septal paradox in DCMP (Table-4)

**Table-4:** Represented relation of septal paradox with LV systolic dysfunction

		LV Systolic dysfunction			Total
		Mild	Moderate	Severe	
Septal paradox present?	Yes	4	9	23	36
	No	6	4	2	12
Total		10	13	25	48

According to age distribution from 1-5 years there were 32 patients, from 5-10years were 9 patients and from above 10 years were 7 patients.

The mean, median, standard deviation range with distribution of MAPSE, A-waves, E-waves E/A, E', E/ E' of LV was the same across the categories of diastolic functions and rejected the null hypothesis (independent-samples Mann- Whitney U test) and significantly correlated. Similarly the distribution of TAPSE, A-waves, E-waves E/A, E', E/ E' of RV significantly correlated with RV dysfunction and rejected the null hypothesis (Table-5).

RV ECHO PARAMETERS					
	Mean	Median	Range	St.deviation	Skewness
TAPSE	21.22	20	40	9.308	0.296
A wave	1.327	0.65	30	4.38	6.884
E wave	1.6323	0.645	40.79	6.69	6.913
E A	1.4054	1.45	1.99	0.4603	-0.907
E' wave	0.216	0.1	1.24	0.2833	2.382
E E'	8.9	8	14.4	4.113	0.147

## DISCUSSION

Right ventricular dysfunction (RVD) noted in DCMP and may added to the clinical severity of disease[15]. Several studies have demonstrated the additional prognostic value of RV dysfunction in heart failure and, most particularly, in idiopathic DCM [16], [17] Dilated cardiomyopathy is primary disease of LV, however certain patients presented with sign and symptoms of right failure resulting from RV dysfunction. Similarly, some study showed that right ventricular and right atrial enlargement occurs later[15]. Our study showed that there was significant involvement of RV dysfunction in cases of DCMP at pediatric groups also that was 39%. It favors the study of **Gulati et al** and **La Vecchia et al**[10,11].

A number of imaging indices are available to evaluate RV systolic function. In addition to RV ejection fraction, other commonly used indices in the clinical arena include the tricuspid annular plane systolic excursion (TAPSE) measured by tissue Doppler imaging. Although TAPSE and TAPSV have been shown to correlate reasonably well with RV ejection fraction[16,17]. By defining RV function based on a threshold of echocardiographic variables in our study showed significant predictors of RV dysfunction. Some study showed that the use of a propensity analysis in this context could provide further information about the prognostic role of RV dysfunction, independent of the level of LV dysfunction, and also about the factors associated with RV function[18,19].

In one study RV systolic dysfunction (RVSD) has been reported as many as 65% of DCM patient suggesting that DCM is frequently a biventricular disease[11]. The potential prognostic impact of

RV impairment in DCM highlighted by two small studies, which suggested that RVSD is an independent predictor of survival [12]. Our study supported this comment. In the group of severe LV dysfunction in our study the diastolic dysfunction of both LV and RV was quite high.

We did this study to estimate the incidence of RV dysfunction in children with dilated cardiomyopathy parameters most representative of RV functions, in such patients and tried to identify various parameters associated with RV dysfunction.

## CONCLUSION

Dilated cardiomyopathy is primary disease of LV, however certain patients presented with sign and symptoms of right

heart failure resulting from RV dysfunction. There was significant involvement of RV dysfunction found ie 39%. Echocardiography helps in the detection of RV involvement in DCMP.

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