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Prognostic significance of myocardial fibrosis as a predictor of left ventricular remodeling

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Abstract

Background: Ventricular remodeling is usually seen after the cardiomyopathies. These are seen in the form of increased left ventricular end diastolic volume (LVEDV), and increased left ventricular mass LV Mass. LVEDV and LV mass are calculate on MRI using Cine imaging.

Methods: The cross sectional hospital based study was conducted in the Department of Radiodiagnosis in patients with heart failure with LVEF(Left Ventricular Ejection Fraction) of <45% without RWM (Regional Wall Motion) abnormality on echocardiography evaluated in department of cardiology at IGMC, Shimla over a period of one year.

Results: The myocardial fibrosis was seen in the 8 (32%) patients of increased left ventricular end diastolic volume and 8(61.54%) patients of normal left ventricular end diastolic volume with insignificant P value of 0.09 and odd ratio of 0.30.

Conclusion: In our study the LVEDV (Left Ventricular end Diastolic Volume) and LV Mass was commonly associated with dilated cardiomyopathy without fibrosis however statistically it was also insignificant.

Keywords: MRI, Myocardial, LVEDV

Introduction

There are various modalities used for the diagnosis of dilated cardiomyopathies. Cardiac MR has advantage of being a noninvasive test with excellent spatial and myocardial tissue resolution. The various combinations of sequences allow the detection, localization, and quantification of many pathologic myocardial processes. Cardiac MR is now gold standard investigation for accurate quantification of chamber size and function in cardiomyopathies. Cine MR Images are used to assess the function of heart and for detecting wall motion abnormalities. Black blood images are used for morphological assessment of heart and surrounding structure. The cardiac MRI can diagnose ischemic cardiomyopathy based upon the Late Gadolinium Enhancement (LGE) along the territory of coronary arteries and also help in tissue characterization of myocardium. Late gadolinium enhancement is usually a predictor of myocardial

fibrosis. Cine MR imaging are used to calculate LVEDV and LV Mass by dedicated argus software.

Material and methods

Study design and patient population and sample size: The cross sectional hospital based study was conducted in the Department of Radiodiagnosis in patients with heart failure with LVEF(Left Ventricular Ejection Fraction) of <45% without RWM(Regional Wall Motion) abnormality on echocardiography evaluated in department of cardiology at IGMC, Shimla over a period of one year. Coronary angiography was done in all eligible patient of dilated cardiomyopathy in the department of Cardiology and CT coronary angiography was planned in patients where coronary angiography was not possible in the department of Radiodiagnosis IGMC, Shimla. The Radiologist who reported the cardiac MRI was blinded to the result of coronary angiography/CT coronary angiography. Comparison of cardiac MRI and coronary angiography was made in the end of the study to find out the accuracy of cardiac MRI in the diagnosis of ischemic cardiomyopathies and differentiating it from the non ischemic cardiomyopathies. Thereafter association between pattern of distribution of myocardial fibrosis with ischemic and non ischemic Cardiomyopathy was made.

Every consecutive eligible patient was enrolled for the study and the research procedure was in accordance with the approved ethical standards of Indira Gandhi Medical College and Hospital, Shimla, Ethics Committee.

Exclusion Criteria

- Patients having contraindication for MRI e.g. Pacemaker, Metallic implants.
- Patients with deranged renal function test with e GFR <15 ml/kg/minute
- Patients with documented myocardial infarction.
- Patients with hypersensitivity to Gadolinium.

Data Analysis

Data was reported as counts and percentages for categorical variables and mean±SD for continuous variables. The association of pattern and distribution of myocardial fibrosis with ischemic cardiomyopathy was analyzed calculating odds ratio and 95% C.I. The statistical analysis was done using Epi info version 7 software. Two sided p value of <0.05 was taken as statistically significant.

Result

The myocardial fibrosis was seen in the 8 (32%) patients of increased left ventricular end diastolic volume and 8(61.54%) patients of normal left ventricular end diastolic volume with insignificant P value of 0.09 and odd ratio of 0.30.

The subendocardial myocardial fibrosis in coronary territory was seen in none of the patients of increased left ventricular end diastolic volume and 5(38.46%) patients of normal left ventricular end diastolic volume with significant P value of < 0.01 and odd ratio of < 1.

The transmural myocardial fibrosis in coronary territory was seen in the 3(12%) patients of increased left ventricular end diastolic volume and 2(15.38%) patients of normal left end diastolic volume with insignificant P value of 1.00 and odd ratio of 0.75.

The transmural myocardial fibrosis in non coronary territory was seen in the 2(8%) patients of increased left ventricular end diastolic volume and not seen in patients of normal left ventricular end diastolic volume with insignificant P value of 0.53 and odd ratio of 1.56.

The myocardial fibrosis in coronary territory was seen in the 3(12%) patients of increased left ventricular end diastolic volume and 6(46.15%) patients of normal left

ventricular end diastolic volume with significant P value of 0.04 and odd ratio of 0.16.

The midmyocardial fibrosis was seen in the 2(8%) patients of increased left ventricular end diastolic volume and 1(7.69%) of normal left ventricular end diastolic volume with insignificant P value of 1 and odd ratio of 1.04. The focal patchy myocardial fibrosis was seen in the 1(4%) patients of increases left ventricular end diastolic volume and 2(15.38%) patients of normal left ventricular end diastolic volume with insignificant P value of 0.26 and odd ratio of 0.23.

There were no patients of subendocardial myocardial fibrosis in non ischemic territory and epicardial myocardial fibrosis.

Table 1: Association of myocardial fibrosis with Left ventricular end diastolic volume (LVEDV)

		Increased Lvedv (N=25)	Normal Lvedv (N=13)	Or	P Value
MYOCARDIAL FIBROSIS	YES	8(32%)	8(61.54%)	0.30	0.09
	NO	17(68%)	5(38.46%)		
SUBENDOCARDIAL CT	YES	0	5(38.46%)	0.00	< **0.01**
	NO	25(100%)	8(61.54%)		
SUBENDOCARDIAL NCT	YES	0	0	-	-
	NO	25	13		
TRANSMURAL CT	YES	3(12%)	2(15.38%)	0.75	1.00
	NO	22 (88%)	11(84.62%)		
TRANSMURAL NCT	YES	2(8%)	0	1.56	0.53
	NO	23(92%)	13(100%)		
FIBROSIS IN CORONARY TERRITORY	YES	3(12%)	6(46.15%)	0.16	**0.04**
	NO	22(88%)	7(53.85%)		
MIDMYOCARDIAL	YES	2(8%)	1(7.69%)	1.04	1.00
	NO	23(92%)	12(92.31%)		
EPICARDIAL	YES	0	0	-	-
	NO	25	13		
FOCAL PATCHY	YES	1(4%)	2(15.38%)	0.23	0.26
	NO	24(96%)	11(84.62%)		

The myocardial fibrosis was seen in the 6(30%) patients of increased left ventricular mass and 10(55.56%) patients of normal left ventricular mass with insignificant P value of 0.18 and odd ratio of 0.35.

The subendocardial myocardial fibrosis in coronary territory was seen in no patients of increased left ventricular mass and 5(27.78%) patients of normal left ventricular mass with significant P value of 0.01 and odd ratio of 0.00.

The transmural myocardial fibrosis in coronary territory was seen in the 1(5%) patients of increased left ventricular mass and 4(13.16%) patients of normal left ventricular mass with insignificant P value of 0.16 and odd ratio of 0.19.The transmural myocardial fibrosis in

non coronary territory was seen in the 2(10%)patients of increased left ventricular mass and not seen in patients of normal left ventricular mass with insignificant P value of 0.48 and odd ratio of 2. The myocardial fibrosis in coronary territory was seen in the 1(5%) patients of increased left ventricular mass and 8 (44.44%) patients of normal left ventricular mass with significant P value of < 0.01 and odd ratio of 0.07.

The midmyocardial fibrosis was seen in the 2(10%) patients of increased left ventricular mass and 1(5.6%) of normal left ventricular mass with insignificant P value of 1 and odd ratio of 1.85.

The focal patchy myocardial fibrosis was seen in the 1(5%) patients of increases left ventricular mass and 2(11.11%) patients of normal left ventricular mass with insignificant P value of 0.59 and odd ratio of 0.43.

There were no patients of subendocardial myocardial fibrosis in non ischemic territory and epicardial myocardial fibrosis

Table 2: Association of pattern of myocardial fibrosis with Left Ventricular Mass (LV Mass);

		INCREASED LV MASS(n=20)	NORMAL LV MASS (n=18)	OR	P VALUE
MYOCARDIAL FIBROSIS	YES	6(30%)	10(55.56%)	0.35	0.18
	NO	14(70%)	8(44.44%)		
SUBENDOCARDIAL CT	YES	0	5(27.78%)	0.00	0.01
	NO	20(100%)	13(72.22%)		
SUBENDOCARDIAL NCT	YES	0	0	-	-
	NO	20	18		
TRANSMURAL CT	YES	1(5%)	4(13.16%)	0.19	0.16
	NO	19(95%)	14(77.78%)		
TRANSMURAL NCT	YES	2(10%)	0	2	0.48
	NO	18(90%)	18(100%)		
FIBROSIS IN CORONARY TERRITORY	YES	1(5%)	8(44.44%)	0.07	< 0.01
	NO	19(95%)	10(55.56%)		
MIDMYOCARDIAL	YES	2(10%)	1(5.66%)	1.85	1.00
	NO	18(90%)	17(94.44%)		
EPICARDIAL	YES	0	0	-	-
	NO	20	18		
FOCAL PATCHY	YES	1(5%)	2(11.11%)	0.43	0.59
	NO	19(95%)	16(88.89%)		

Discussion

In our study we have taken increased left ventricular end diastolic volume and increased left ventricular mass as a predictor of LV remodeling. The increased LVEDV and LV mass were more commonly seen in the cardiomyopathies without fibrosis with P value of

0.09 and 0.18 respectively however statistically it was insignificant. The LVEDV was increased in 25 patients out of which 8(32%) had myocardial fibrosis and normal in 13 patients out of which 8(61.54%) had myocardial fibrosis. The myocardial fibrosis was seen in total 16 patients, out of which 8(50%) patients had increased LVEDV and 8(50%) patients had normal LVEDV, thus no significant association was seen with myocardial fibrosis. Similar pattern is seen with the LV mass with 6 (37.5%) patients of myocardial fibrosis showing increased LV mass and 10 (62.5%) patients of myocardial fibrosis showing normal LV Mass with insignificant P value of 0.18. However in a study done by Lehrke **S et al**[12] noted that LGE positive patients of DCM were associated with a lower left ventricular (LV) ejection fraction, higher LV end-diastolic volume index and higher LV mass. They further concluded that in DCM patient with LGE was associated with pronounced LV remodeling, functional impairment and adverse outcome. This is not in agreement with our study which may be due to less prevalence of myocardial fibrosis (18.75%) in non ischemic cardiomyopathy in our study.

Conclusion

In our study the LVEDV (Left Ventricular end Diastolic Volume) and LV Mass was commonly associated with dilated cardiomyopathy without fibrosis however statistically it was also insignificant. This is due to small sample size in our study. Detail study with larger sample size needs to be done to evaluate the accurate assessment of correlations between the left ventricular remodeling and myocardial fibrosis.

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