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Association of pattern of myocardial fibrosis with cardiac arrhythmias

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Abstract

Background: Myocardial fibrosis is frequently seen after the cardiomyopathies. Fibrosed myocardial tissue is usually substrate to cardiac arrhythmias in these patients. Greater the extent of myocardial fibrosis more is the chance of developing cardiac arrhythmias. There is a higher mortality rate in cardiomyopathies patients with cardiac arrhythmias.

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 6 (40%) patients of arrhythmias and 3 (30%) patients of no arrhythmias with insignificant P value of 0.69 and odd ratio of 1.52. The subendocardial myocardial fibrosis in coronary territory was seen in the 3(20%) patients of arrhythmias and 2(20%) patients of no arrhythmias with insignificant P value of 1.00 and odd ratio of 1

Conclusion: No association of myocardial fibrosis with arrhythmias on holter study was found in our study.

Keywords: MRI, Myocardial, Arrhytmia

Introduction

The etiologies of cardiomyopathies are conventionally divided into primary and secondary causes. The primary cardiomyopathies solely involve heart and are intrinsic to myocardium. The secondary cardiomyopathies are those which are part of multiorgan involvement. "The 2006 American Heart Association'' classified the primary cardiomyopathies as genetic type, acquired type and mixed type. The genetic type of cardiomyopathies includes Hypertrophic cardiomyopathy, Arrhythmogenic right ventricular dysplasia, Left ventricular non compaction and various Storage diseases. The acquired type include inflammatory (myocarditis), stressed provoked or peripartum cardiomyopathies. The mixed type of cardiomyopathies includes dilated cardiomyopathies and restrictive cardiomyopathies. The secondary

cardiomyopathies includes various multisystemic disease like amyloidosis. Cardiac arrhythmias is more likely seen in the cardiomyopathies with fibrosis as fibrosed tissue is more prone to arrhythmias. Mortality is higher in the presence of fibrosis involving myocardial tissue.

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. Cardiac arrhythmias is diagnosed with 24 hour holter study. 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

1. Patients having contraindication for MRI e.g. Pacemaker, Metallic implants.
2. Patients with deranged renal function test with e GFR <15 ml/kg/minute
3. Patients with documented myocardial infarction.
4. 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 6 (40%) patients of arrhythmias and 3 (30%) patients of no arrhythmias with insignificant P value of 0.69 and odd ratio of 1.52.

The subendocardial myocardial fibrosis in coronary territory was seen in the 3(20%) patients of arrhythmias and 2(20%) patients of no arrhythmias with insignificant P value of 1.00 and odd ratio of 1.

The transmural myocardial fibrosis in coronary territory was seen in the 2(13.33%) patients of arrhythmias and not seen in patients with no arrhythmias with insignificant P value of 0.50 and odd ratio of 1.76.

The transmural myocardial fibrosis in non coronary territory was seen in the 1(6.67%) patients of arrhythmias and not seen in patients with no arrhythmias insignificant P value of 1.00 and odd ratio of 1.71.

The myocardial fibrosis in coronary territory was seen in the 4(26.67%) patients of arrhythmias and 2(20%)

patients of no arrhythmias with insignificant P value of 1.00 and odd ratio of 1.43.

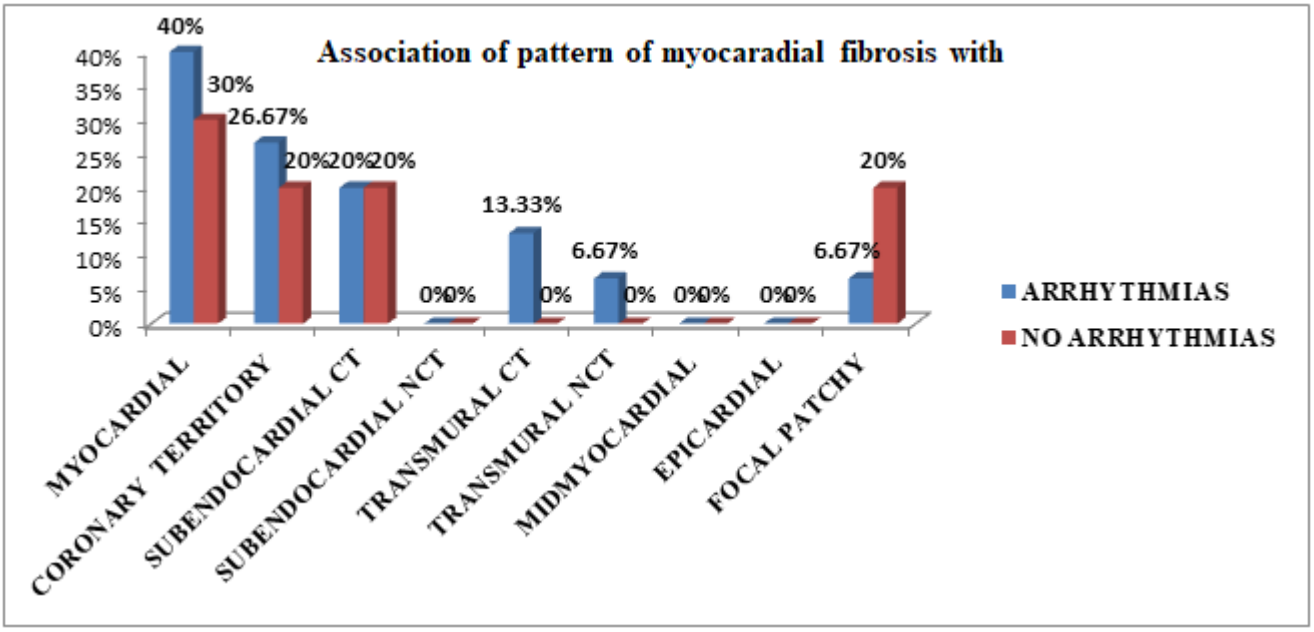
The focal patchy myocardial fibrosis was seen in 1(6.67%) patients of arrhythmias and 2(20%) patients of no arrhythmias with insignificant P value of 0.54 and odd ratio of 0.30.

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

Table 1: Association of pattern of myocardial fibrosis with arrhythmias on Holter study in study sample;

		Arrhythmia (n=15)	No arrhythmia (n=10)	OR	P value
MYOCARDIAL FIBROSIS	YES	6(40%)	3(30%)	1.52	0.69
	NO	9(60%)	7(70%)		
SUBENDOCARDIAL CT	YES	3(20%)	2(20%)	1	1.00
	NO	12(80%)	8(80%)		
SUBENDOCARDIAL NCT	YES	0	0	-	
	NO	15	10		
TRANSMURAL CT	YES	2(13.33%)	0	1.76	0.50
	NO	13(86.67%)	10(100%)		
TRANSMURAL NCT	YES	1(6.67%)	0(0%)	1.71	1.00
	NO	14(93.33%)	10(100%)		
FIBROSIS IN CORONARY TERRITORY	YES	4(26.67%)	2(20%)	1.43	1.00
	NO	11(73.33%)	8(80%)		
MIDMYOCARDIAL	YES	0	0	-	
	NO	15	10		
EPICARDIAL	YES	0	0	-	
	NO	15	10		
FOCAL PATCHY	YES	1(6.67%)	2(20%)	0.30	0.54
	NO	14(93.33%)	8(80%)		

Graphical presentation of association of pattern of myocardial fibrosis with arrhythmias on Holter study



(CT- Coronary Territory, NCT- Non Coronary Territory)

Discussion

In our study holter study was done in 25 patients out of total 38 patients. It is evident from the literature that arrhythmias are commonly seen in cardiomyopathy with myocardial fibrosis. The fibrotic tissue in myocardium serves as arrhythmogenic substrate to arrhythmias in patients with cardiomyopathy. Arrhythmias were seen in 15 patients out of total 25 patients in our study. Among 15 patients with arrhythmias 9 (36%) had myocardial fibrosis and 16 (64%) patients had no myocardial fibrosis. Arrhythmias were seen in the 6 (66.66%) patients with myocardial fibrosis and in 9 (56.25%) patients without myocardial fibrosis. There were no association seen between myocardial fibrosis and arrhythmias in our study. While in a retrospective study performed by **Leah Iles et al**[3] (2010), CMR was done on 103 patients meeting criteria for ICD implantation for primary prevention of SCD before device implantation. There was a discharge rate of 29% in the NICM group with LGE compared with a 14% in the ICM group. There were no ICD discharges in the NICM group without LGE, which was significantly lower than the rate observed in both the ICM patients ($p = 0.04$) and the NICM patients with LGE ($p < 0.01$). They concluded that absence of LGE may indicate a lower risk for malignant ventricular arrhythmias. The above findings are not in agreement with our study. In a study conducted by **Ravi G Assomell *et al***[4] (2006) on 101 consecutive DCM patients, the midwall fibrosis was seen 35% of patients and was associated with a higher rate of the predefined primary combined end point of all-cause death and hospitalization for a cardiovascular event. Midwall fibrosis also predicted secondary outcome measures of sudden cardiac death (SCD) or ventricular tachycardia (VT) with hazard ratio of 5.2 and P value of 0.03. The findings are not in concordance with our study.

Conclusion

No association of myocardial fibrosis with arrhythmias on holter study was found in our study probably due to small size of study population.

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