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Study of left ventricular diastolic dysfunction in ischemic heart disease-evaluation by Doppler echocardiography at aims rural hospital

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Abstract

Background: There is growing recognition that congestive heart failure caused by a Predominant abnormality in diastolic function is both common and causes significant morbidity and mortality. Hence we aimed to evaluate the application of Doppler echocardiography in determining left ventricular diastolic dysfunction in IHD.

Objectives:

- 1) To evaluate Doppler echocardiography in determining left ventricular diastolic dysfunction (DD) in ischemic heart disease.
- 2) To evaluate left ventricular diastolic dysfunction in ischemic heart disease.
- 3) To find out early left ventricular diastolic dysfunction in ischemic heart disease.

Methodology: Present study is based on analysis of 60 patients of IHD (UA, AMI, IMI) admitted to Adichunchanagiri Hospital and research centre from November 2012 to September 2014. Detailed history and physical examination was done. Every patient was subjected to ECG, CXR, routine investigations and Doppler Echo cardiography.

Results: A total of 60 patients were studied. 23 patients showed diastolic dysfunction with E/A ratio <1, with increased atrial filling fraction and prolonged isovolumetric relaxation time.

Conclusion: Our findings suggest that myocardial damage in patients with IHD affects diastolic dysfunction before systolic dysfunction.

Keywords: Doppler echocardiography, Ischemic heart disease, Diastolic dysfunction

Introduction

Cardiovascular diseases (CVDs) are the most common cause of death and disability worldwide. This is true for developed countries as well as developing countries like India which are expected to face a phenomenal increase in the burden of chronic diseases like coronary artery disease in the near future.

While CVDs are currently a predominant cause of death in India, they are likely to be the overwhelming cause of mortality and morbidity in the future of all CVDs, the predominant cause of mortality and morbidity is CHD. The likely cause of this epidemic a part of the surge in chronic diseases like coronary artery disease lies in the country's epidemiologic transition. This transition is characterized by rapid urbanization and its accompanying adverse lifestyle changes (eg: drug and alcohol addictions, unhealthy diet, physical inactivity, and increasing psychosocial ailments) and by increasing longevity.¹

Till the recent past, all the importance was being given to the systolic function of the heart even in the genesis of congestive heart failure, the role of systolic ventricular has been well recognized and stressed upon, time and again in the current literature.

But it is in this last ten years that clinicians and researchers have discovered that reversible and irreversible abnormalities of left ventricular diastolic function contribute significantly to symptoms in individuals with a variety of cardiac disorders, including those with normal or near normal systolic function. This has important therapeutic implications can also help physicians for planning, early intervention strategies. Thus DD can be used as an early indicator, as it is a precursor to increased left ventricular mass, left ventricular hypertrophy and clinical left ventricular failure and clinical significant debilitating condition.²

Objectives

1. To evaluate Doppler echocardiography in determining left ventricular diastolic dysfunction (DD) in ischemic heart disease.
2. To evaluate left ventricular diastolic dysfunction in ischemic heart disease.
3. To find out early left ventricular diastolic dysfunction in ischemic heart disease.

Methodology

Source of Data

The subjects are recruited from rural patients admitted to our rural hospital in ICCU under Medicine Department, at Adichunchanagiri Hospital and Research Centre, B.G. Nagara, Mandya.

Type of study: Descriptive study

Study Period: November 2012 to September 2014.

Sample Size: 60

Sampling Technique: Non probability purposive sampling 60 patients presenting with ischemic heart disease (unstable angina, anterior wall myocardial infarction and inferior wall myocardial infarction) who were not hypertensive, Admitted to Adichunchanagiri hospital under the department of general medicine were studied. Detailed history and physical examination was done. Patients with IHD without DD were taken as controls. All patients were subjected to color Doppler echocardiographic examination.

Inclusion Criteria

- Patients >18 years of age
- Patients with IHD who are not hypertensive.

Exclusion Criteria

- Patients with renal disease, diabetes mellitus, secondary hypertension.
- Patients with valvular heart disease
- Patients with congenital heart disease.

All those included for study were subjected to;

- M-Mode left ventricular study
- Transmitral Doppler echocardiographic study of left ventricular inflow pattern.
- Combined study of Doppler echocardiography and phonocardiography to measure isovolumetric relaxation time.

Following Doppler echocardiographic indices of left ventricular function were measured.

Doppler Study

- Peak velocity of early mitral flow – E - velocity cm/sec.
- Peak velocity of late mitral flow – A - velocity cm/sec.
- E/A ratio
- Velocity time integral of total diastolic flow (VTIM – cms)
- Velocity time integral of atrial wave (VITA – cms)
- Atrial filling fraction (VTIA / VTIM ratio)
- Isovolumetric relaxation time (IRT in msec)

M-Mode Left Ventricular Study

- LVIDs (mm)
- LVIDd (mm)
- Ejection Fraction = $(LVIDd3 - LVIDs3 / LVIDd3) \times 100$

All the patients were subjected to detailed clinical examination routine hematological and biochemical examination, FBS, urea, creatinine, SGOT, LDH, CPK, serum cholesterol, urine examination, ECG, CXR (PA View).

Statistical Method

Data was entered in excel format and analyzed using Epi-Info software. Descriptive statistics like frequencies and percentages were calculated. Continuous data are expressed as mean±SD and between groups are compared with unpaired student ‘t’ test. P<0.05 was significant.

Results

60 patients with IHD admitted in Adichunchanagiri hospital and research centre, attached to Sri Adichunchanagiri Institute of Medical Sciences, B.G. Nagara, during November 2012 to September 2014 were analyzed.

Table 1: Age Distribution

Age	Normal	%	DD	%
30-39	2	5	4	11
40-49	7	18	2	5
50-59	14	37	6	16
60-69	8	21	7	19
70-79	3	8	4	11
80-89	3	8	0	0
Total	37		23	
Mean + SD	57.22 + 11.73		55.48 + 13.67	

In our study patients with IHD were in the age group ranging from 30-90 years. The age group of 60-69 had maximum number of cases (19).

Table 2: Sex Distribution

Sex	Normal	DD
Male	28 (76)	18 (78)
Female	9 (24)	5 (22)

Out of 60 IHD cases, 46 (76%) were males and 14 (24%) were females. DD was present in 18(78%) of males and 5(22%) of females.

TABLE 3: Doppler Echocardiographic Indices of Patients with Ischemic Heart Disease and Controls (Mean +/- SD)

Echo Doppler Index	Controls (n=38)	Present (n=23)	t* Value	P Value	Significance
E-v (cm/sec)	67.92 ± 7.93	62.43 ± 4.10	3.06	P < 0.01	S
A-v (cm/sec)	52.22 ± 10.23	78.83 ± 5.50	11.46	P < 0.001	HS
E/A Ratio	1.34 ± 0.27	0.79 ± 0.07	9.53	P < 0.001	HS
VTIA (cm)	4.29 ± 1.60	6.05 ± 1.81	3.94	P < 0.001	HS
VTIM (cm)	12.49 ± 3.86	13.58 ± 1.32	1.30	P > 0.05	NS
VITA/VITM	0.2 ± 0.09	0.44 ± 0.12	4.43	P < 0.001	HS
LVIDd (mm)	41.54 ± 5.53	44.72 ± 5.55	2.16	P > 0.05	NS
LVIDs (mm)	29.27 ± 3.91	32.52 ± 4.83	2.85	P > 0.01	S
EF%	62.05 ± 4.66	60.17 ± 4.48	1.54	P < 0.05	NS
IRT (m sec)	81.73 ± 8.37	120.52 ± 11.88	14.80	P < 0.001	HS

E-velocity (cm/sec) was decreased in study group compared to control group (62.43 ± 4.1 Vs 67.92 ± 7.93) P value was significant P<0.01. A-velocity (cm/sec) was increased in study group compared to controls. Data was highly significant. P<0.001 (78.83 ± 5.5 Vs 52.22 ± 10.23). E/A Ratio – was reduced in study group compared to controls (0.79 ± 0.07 Vs 1.34 ± 0.27). Data was highly significant. P<0.001. VITA (cms) was increased in our study group compared to control group (6.05 ± 1.81 Vs 4.29 ± 1.6). Data was highly significant. P<0.001. VITM (cms) was slightly increased in study group compared to control group (13.58 ± 1.32 Vs 12.49 ± 3.86). P value was not significant. VITA / VITM ratio was increased in study group compared to control group (0.44 ± 0.12 Vs 0.32 ± 0.09). Data was highly significant. P<0.001. LVIDd (mm) did not change in our study group compared to control group (44.72 ± 5.55 Vs 41.54 ± 5.53). P value was not significant. There was no difference in the ejection fraction percentage in both the study and control groups (60.17 ± 4.48 Vs 62.05 ± 4.66). P value was not significant. Analysis of Data shows that diastolic filling abnormalities are common in patients with impaired relaxation than in patients with normal relaxation.

Table 4: Association of ECG Wise Unstable Angina and Diastolic Dysfunction

UNSTABLE ANGINA TOTAL	WITH DD	WITHOUT DD
43	19	24

Table 5: Association of ECG Wise AWMI and Diastolic Dysfunction

AWMI TOTAL	WITH DD	WITHOUT DD
14	7	7

Table 6: Association of ECG Wise IWMI and Diastolic Dysfunction

IWMI TOTAL	WITH DD	WITHOUT DD
3	0	3

Discussion

Table 7: Comparison of Echo Doppler Indexes of IHD

Echo Doppler Index	Present Study	Stoddard M F <i>et al.</i> , ^[60]
E-velocity (cm/sec)	62.43 ± 4.10	60.20 ± 15.60
A-velocity (cm/sec)	78.83 ± 5.50	57.10 ± 15.60
E/A Ratio	0.79 ± 0.07	1.21 ± 0.71
VTIA	6.05 ± 1.81	5.10 ± 1.50
VTIM	13.58 ± 1.32	14.30 ± 3.50
VITA/VITM	0.44 ± 0.12	0.37 ± 0.13
LVIDd	44.72 ± 5.55	51.0 ± 7.0
LVIDs	32.52 ± 4.83	-
EF%	60.17 ± 4.48	63.0 ± 15.0
IRT	120.52 ± 11.88	70.0 ± 21.0

E/A ratio is reduced in our study group because of increased late mitral flow. Atrial filling fraction (VTIA/VTIM ratio) in present study is higher, indicating that atrial contribution to the ventricular filling was higher because of decreased ventricular compliance. Present study showed higher values of isovolumetric relaxation time which denotes that aortic relaxation during early diastolic filling is impaired. However, isovolumetric relaxation time is influenced by other variables like left atrial pressure at mitral opening and aortic pressure at aortic valve closure.

Conclusion

Myocardial ischemia and infarction may adversely affect both relaxation and compliance. Also, patients with impaired relaxation with ischemic heart disease, increasing impairment in relaxation correlated with decreasing peak velocity of early filling and increased atrial contribution to filling. Hence, Doppler echocardiography is reliable, non-invasive investigative method of detecting left ventricular DD. However, compared to radionuclide and catheterization studies. Doppler echocardiographic method is faster, safer, non-invasive, more economical study and can be done bedside without any risks to the patient which are inherent with radionuclide and catheterization techniques.

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