



A STUDY OF LEFT VENTRICULAR DIASTOLIC DYSFUNCTION IN PRIMARY HYPERTENSION -EVALUATION BY DOPPLER ECHOCARDIOGRAPHY

Dr.P.Sudhakar	MD., Professor of Medicine, Kurnool Medical College & Govt. General Hospital, Kurnool.
Dr.M.Maheswara Reddy*	MD., Associate Professor of Medicine, Kurnool Medical College & Govt. General Hospital, Kurnool. *Corresponding Author
Dr.K.Naveen Kumar	MD., Resident of Medicine, Kurnool Medical College, & Govt. General Hospital, Kurnool.

ABSTRACT **Background:** Heart failure is a clinical syndrome characterized by symptoms and signs of increased tissue/organ water and decreased tissue/organ perfusion. Diastolic heart failure is a clinical syndrome characterized by the symptoms and signs of heart failure, a preserved ejection fraction (EF), and abnormal diastolic function. Abnormalities in diastolic function can occur in the presence or absence of a clinical syndrome of heart failure and with normal or abnormal systolic function. Therefore, whereas Diastolic Dysfunction describes an abnormal mechanical property, diastolic heart failure describes a clinical syndrome.

Aims & Objectives:

- 1) To evaluate significance of left ventricular diastolic dysfunction in essential hypertension.
- 2) To find out early left ventricular diastolic dysfunction in essential hypertension as a marker of impending major cardiac events and to promote the quality of life.
- 3) To evaluate application of Doppler echocardiography in determining left ventricular diastolic dysfunction in essential hypertension.

Materials and Methods: 75 patients of primary hypertension admitted to Govt. General Hospital during April 2014 to September 2015 were studied.

Results: The left ventricular filling studies by Doppler echocardiography done in study and control population were analysed and the results are as follows. In our study, patients with hypertension, There were 53 (70%) males and 22 (30%) females in this study. E-velocity (cm/sec) was reduced in study group compared to control group, A-velocity (cms/sec) was increased in study group compared to control, E/A ratio was reduced in study group compared to controls, LVI Diastolic Dysfunction (mm) did not change in the study group compared to controls, Ejection fraction percentage in study group was decreased compared to controls.

Conclusion: This study suggests that in the early stages of hypertensive heart disease, before there is a detectable increase in left ventricular chamber size, sustained elevation of blood pressure is associated with abnormal left ventricular filling despite normal systolic function, as was also noted in Framingham and Rovner studies. However, compared to radionuclide and catheterization studies, Doppler echo cardiographic method is faster, safer, non-invasive, more economical study can be done bedside without any risks to the patient which are inherent with radionuclide and catheterization techniques.

KEYWORDS : Hypertension, Ischemic Heart disease, Diastolic Dysfunction, Doppler Echocardiography

INTRODUCTION:

Cardiovascular diseases (CVDs) are the most prevalent 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 in the near future. 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. But it is in this last decade 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 Diastolic dysfunction 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.

On average, 40 percent of patients with heart failure have preserved systolic function.¹ The incidence of diastolic heart failure increases with age, and it is more common in older women.² Hypertension and cardiac ischemia are the most common causes of diastolic heart failure (Table 2). Common precipitating factors include volume overload; tachycardia; exercise; hypertension; ischemia; systemic stressors (e.g., anemia, fever, infection, thyrotoxicosis); arrhythmia (e.g., atrial fibrillation, atrioventricular nodal block); increased salt intake; and use of nonsteroidal anti-inflammatory drugs.

AIMS & OBJECTIVES

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determining left ventricular diastolic dysfunction in essential hypertension.

- 2) To evaluate significance of left ventricular diastolic dysfunction in essential hypertension.
- 3) To find out early left ventricular diastolic dysfunction in essential hypertension as a marker of impending major cardiac events and to promote the quality of life.

MATERIALS AND METHODS

75 patients of primary hypertension and admitted to Govt. General Hospital during April 2014 to September 2015 were studied.

Control Groups:

Patients with hypertension without Diastolic Dysfunction were taken as controls.

All patients were subjected to color Doppler echocardiographic examination.

Inclusion Criteria:

- Patients >18 years of age
- Patients with primary hypertension

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)
LVI Diastolic Dysfunction (mm)
Ejection Fraction = (LVI Diastolic Dysfunction3 – LVIDs3 / LVI Diastolic Dysfunction3) x 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).

RESULTS

75 patients with primary hypertension admitted to Govt. General Hospital, Kurnool, during April 2014 to September 2015 were analysed.

A. AGE DISTRIBUTION (HTN)

In our study, patients with hypertension were in the age ranging from 30-90 years, with mean age of 60 years in control group and 63 years in study group. Age groups were comparable. There was no significant difference among the two groups

TABLE 1:

Age	Normal	%	Diastolic Dysfunction	%
30-39	1	3	1	3
40-49	5	13	4	11
50-59	11	29	8	22
60-69	11	29	13	35
70-79	7	18	9	24
80-89	3	8	2	5
Total	38		37	
Mean+/- SD	59.76+/-11.74		62.86+/-11.56	

t*Value=1.15 P=0.25 Not Significant

SEX DISTRIBUTION.

There were 29 (78%) males and 8 (22%) females in the study groups. Among the study group 24 patients had LVH and 13 patients did not have LVH.

TABLE 2:

Sex	Normal	DIASTOLIC DYSFUNCTION	X2 *Value	Significance
Male	24 (63)	29 (78)	1.42	P=0.23 Not
Female	14 (37)	8 (22)		

DOPPLER ECHOCARDIOGRAPHIC INDICES OF THE PATIENTS WITH PRIMARY HYPERTENSION AND CONTROLS (mean±SD)

TABLE: 3

Echo Doppler Index	Normal (n=38)	Present (n=37)	t* Value	P Value	Significance
E-v (cm/sec)	64.53±7.59	60.05±5.99	2.82	P<0.01	S
A-v (cm/sec)	52.89±9.86	73.81±6.29	10.91	P<0.001	HS
E/A Ratio	1.25±0.27	0.82±0.07	9.69	P<0.001	HS
VTIA (cm)	5.06±2.11	6.12±1.57	2.46	P<0.05	S
VTIM (cm)	13.7±3.04	14.32±2.1	1.03	P>0.05	NS

VTIA/VTIM	0.35±0.10	0.42±0.09	3.52	P<0.001	HS
LVIDiastolic Dysfunction (mm)	43.16±5.95	43.03±6.26	0.09	P>0.05	NS
LVIDs (mm)	30.55±3.67	30.62±5.17	0.06	P>0.05	NS
EF%	63.39±6.01	59.81±5.73	2.64	P<0.05	S
IRT (m sec)	77.08±10.45	114.16±17.0	11.4	P<0.001	HS

*Student's Unpaired t Test. S =Significant, HS= Highly Significant, NS=Not Significant.

COMPARISON OF E/A RATIO (HTN)

E/A ratio was reduced in the present study because suggesting increased late mitral flow.

TABLE: 4

Echodoppler Index	Present study Measurements	Rovner et al58.,
E-Velocity	60.05 ± 5.99	75.0± 21.0
A-Velocity	73.81 ± 6.29	69.0±20.0
E/A Ratio	0.82 ± 0.07	1.1±0.5

ATRIAL FILLING FRACTION:

Atrial filling fraction in primary hypertension is not compared with the above-mentioned study, as the authors did not elucidate the same. So atrial filling fraction measurement of present study is compared with that of the Framingham heart study.

Atrial filling fraction in our study group is higher implying that atrial contribution to ventricular filling was higher which is due to decrease in the ventricular compliance.

TABLE -5: COMPARISON OF ATRIAL FILLING FRACTION(HTN):

Echo doppler Index	Present study	Framingham Heart Study59
Atrial filling fraction	0.42 ± 0.09	0.31 ± 0.08

COMPARISON OF ISOVOLUMETRIC RELAXATION TIME(HTN) WITH ROVNER ETAL

Isovolumetric relaxation time of present study is increased and is similar to the findings of Rovner et al.

TABLE:6

Echodoppler Index	Present study	Rovner et al.58,
Isovolumic relaxation time	114.16 ± 17.02	112.0 ± 29.0

DISCUSSION

Systolic versus diastolic HF

Patients with chronic HF can be divided into two categories on the basis of characteristic changes in cardiovascular structure and function³.

Systolic HF (SHF) is characterized by abnormalities in systolic function (i.e. reduced left ventricular ejection fraction [LVEF]) usually with progressive chamber dilation and eccentric remodelling. Because the dominant abnormality is in systolic function, this syndrome is called SHF. This syndrome is also called HF with a reduced LVEF (HFrEF). SHF has been defined by a variety of LVEF partition values ranging from less than 35 to 50 percent. Our preference is to define SHF by an LVEF <50 percent. Diastolic HF (DHF) is characterized by a normal LVEF, normal LV end-diastolic volume, and abnormal diastolic function, usually with concentric remodelling or hypertrophy⁴. The dominant abnormality resides in diastole. However, in clinical practice, the diagnosis of DHF is often one of exclusion based on the finding of a normal or near normal (or "preserved") LVEF. As a result, this syndrome is also called "HF with preserved EF" (HFpEF). DHF may be best defined as HF with LVEF >50 percent and evidence of diastolic dysfunction.

Diastolic dysfunction in DHF — In DHF, abnormalities in diastolic function form the dominant pathophysiologic basis for the development of the clinical syndrome of HF The major abnormalities in LV diastolic function are:

- Slowed, delayed, and incomplete myocardial relaxation
- Impaired rate and extent of LV filling
- Shift of filling from early to late diastole

- Increased dependence on LV filling from atrial contraction
- Decreased early diastolic suction/recoil
- Increased LA pressure during the early filling
- Increased passive stiffness and decreased dispensability of the LV
- Impaired ability to augment cardiac output during exercise
- Reduced ability to augment relaxation during exercise
- Limited ability to utilize the Frank-Starling mechanism during exercise

Hypertension is the major cause of congestive cardiac failure all over the world. It is under diagnosed and achievement of optimal therapy is difficult and costly. Diastolic dysfunction is an early poor prognostic factor in hypertension and is a reversible condition. Early detection and treatment is necessary to avoid cardiac complications.

CONCLUSION

- To conclude, this study suggests that in the early stages of hypertensive heart disease, before there is a detectable increase in left ventricular chamber size, sustained elevation of blood pressure is associated with abnormal left ventricular filling despite normal systolic function as was also noted in Framingham and Rovner studies.
- Statistical analysis of data indicates that there is significant positive relationship between primary hypertension and the onset of Diastolic Dysfunction and being more common in those with LVH than without LVH.

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