



## A STUDY OF LEFT VENTRICULAR DIASTOLIC DYSFUNCTION IN PATIENTS WITH HYPERTENSION

**Dr Nilofer Seema**

MD., Assistant Professor, Dept. of General Medicine, Kurnool Medical College/ Govt. General Hospital, Kurnool

**Dr.K.Manoraju\***

MD., Associate Professor, Dept. of General Medicine, Kurnool Medical College/ Govt. General Hospital, Kurnool.\*Corresponding Author

**ABSTRACT** Hypertension is the major cause of congestive cardiac failure all over the world. The progression of hypertensive involvement toward heart failure includes myocardial fibrosis and changes of left ventricular (LV) geometry. In the presence of these abnormalities, diastolic abnormalities occur and are defined as LV diastolic dysfunction (DD). They include alterations of both relaxation and filling, precede alterations of chamber systolic function and can induce symptoms of heart failure even when ejection fraction is normal. DD may be asymptomatic and identified occasionally during a Doppler-echocardiographic examination. Diastolic dysfunction is an early poor prognostic factor in hypertension and is a reversible condition. Early detection and treatment are necessary to avoid cardiac complications. The analysis of diastolic dysfunction was based on the E/A ratio using a Doppler echocardiogram. A total of 50 patients diagnosed to have hypertension with preserved systolic function (EF>50%) were studied.

**KEYWORDS :** DD, SBP, DBP, EF, E/A, LVIDS, LVIDD, LVH, HFpEF

### INTRODUCTION:

To assess diastolic dysfunction in hypertensive patients with preserved left ventricular systolic function by combined transmitral flow velocity curve and pulmonary venous doppler analysis, particularly focusing on the limitation of the transmitral flow velocity curve alone to detect diastolic dysfunction.

### MATERIALS AND METHODS:

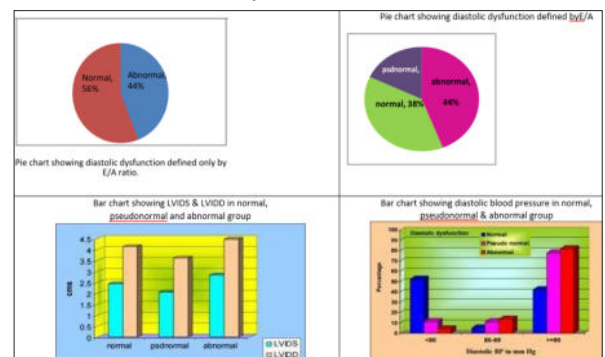
This was a prospective cross-sectional study where hypertensive patients attending the outpatient Department of General Medicine at GGH, Kurnool were selected randomly for enrolment into the study. A total of 50 patients diagnosed to have hypertension with preserved systolic function (EF>50%) were studied from October 2014 to September 2016. Due to the lack of data on E/A ratio values in the Indian population, 50 age and sex-matched healthy controls were enrolled in the study to obtain a normal E/A ratio in different age groups. A total of 50 hypertensive patients were included in the study. The number of males was 29 (58%) and that of females was 21 (42%). The patient's age ranged from 23 to 64 years. Fifty age and sex-matched healthy controls were also evaluated to obtain the normal E/A ratio values in different age groups.

### RESULTS:

Most cases (60%) were between 31-50 yrs of age. Males constituted 58% and females 42% of the study group. The mean systolic blood pressure and diastolic blood pressure in cases were  $156.52 \pm 18.36$  and  $91.40 \pm 7.51$  mmHg respectively. In controls SBP and DBP were normal. LVIDS and LVIDD were lower in cases compared to controls. The ejection fraction was normal (>50%) in both cases and controls.

E/A ratio of controls were obtained for each age group. The mean E/A ratio - 2SD in each age group of controls was taken as the lower limit of the normal E/A ratio for defining normal and abnormal diastolic function in our study. The E/A ratio ranged from 0.4 to 2.14 in cases with a mean of  $1.21 \pm 0.42$ . In controls, E/Aratio ranged from 1.13 to 2.00 with a mean of  $1.38 \pm 0.18$ . E/A ratio was significantly lesser in cases when compared to controls ( $p = 0.001$ ). Fifty-six per cent of cases had normal diastolic function as defined by the E/A ratio, as compared to 44% who had an abnormal diastolic function. E/A ratio was significantly lower in cases that had abnormal diastolic function as compared to cases that had normal diastolic function ( $p < 0.001$ ). The majority of males had normal diastolic function (64%). In the abnormal diastolic function group, sex distribution was equal. More than half of the cases with abnormal diastolic function (defined by abnormal E/A ratio) had a duration of hypertension of more than 12 months. The level of SBP was not significantly associated with diastolic dysfunction as defined by the abnormal E/A ratio. DBP <80 and >90 mmHg was significantly associated with an abnormal E/A ratio. Cases who had normal diastolic function as defined by normal E/A ratio values were further analysed about  $\Delta d$  (pulmonary venous A wave duration- mitral A wave duration), whose value if more than or equal to '0' indicated diastolic dysfunction. Out of 56% of cases with

normal diastolic function (defined by E/A ratio),  $\Delta d$  was found to be abnormal in 18% (9 cases). These patients would have been characterised as having normal diastolic function if E/Aratio was used alone. Thus, estimation of  $\Delta d$  resulted in the detection of 9 more cases of diastolic dysfunction. This group of cases with normal E/A ratio but abnormal  $\Delta d$  was having a "pseudonormal pattern" of diastolic dysfunction. The mean E/A ratio of the pseudonormal group was  $1.55 \pm 0.16$ , was comparable with the group which had normal diastolic function ( $1.51 \pm 0.23$ ), but was significantly higher than the group which had abnormal diastolic function ( $0.80 \pm 0.22$ ) ( $p < 0.001$ ). Sixty-two per cent of cases had diastolic dysfunction as defined by abnormal E/A ratio and  $\Delta d$ . Among all the cases E/A ratio was normal in 19 cases. Twenty-two cases had an E/A ratio less than the age-adjusted normal range indicating abnormal diastolic function. Nine cases had the pseudonormal pattern (E/A normal,  $\Delta d$  abnormal). The ejection fraction was normal among all groups of cases. Both LVIDS and LVIDD were maximum in the group with abnormal diastolic function and minimum in the group with the pseudonormal pattern. Both values were statistically significant ( $p=0.000$  for each). This was indicative of the restrictive filling pattern of LV due to decreased compliance. Cases with diastolic dysfunction are more likely to have hypertension more than 12 months (odds ratio- 1.46). In cases with a pseudonormal pattern, the duration of hypertension was more likely to be more than 6 months (66% of cases). With the progressive rise in systolic blood pressure, there was an increased tendency to develop diastolic dysfunction [odds ratio- 0.32 (SBP  $\leq$  140) to 4.32 (SBP  $\geq$  180)]. Both diastolic blood pressures <80 and  $\geq$ 90 mm of Hg were significantly associated with diastolic dysfunction. There was no association between LVH and diastolic dysfunction.



### DISCUSSION:

In India, the hypertensive population is estimated to reach 213 million by the year 2025. HFpEF is common among patients with hypertension. The prognosis of patients suffering from diastolic heart failure is as ominous as the prognosis of patients suffering from systolic heart failure. In recent years, there is an increased interest in understanding the diastolic function and its importance in common cardiovascular diseases.

Subjects in our study underwent echocardiographic examination where the diastolic function was assessed by transmitral flow velocity curves and E/A ratio [ratio of mitral early diastolic filling wave (E) velocity to mitral atrial contraction wave (A) velocity].

**Pseudonormal Group:** Cases with normal E/A ratio were further evaluated for a pseudonormal pattern of diastolic dysfunction defined by  $\Delta d$ , an indicator of LV filling and diastolic function. 18% of cases in our study with normal E/A ratio were found to have a pseudonormal pattern of diastolic function i.e. normal E/A ratio but abnormal  $\Delta d$ .

Internal diameters of the left ventricle during systole and diastole are reflective of both systolic and diastolic function.

Both LVIDD and LVIDS were significantly higher in the abnormal diastolic function group and significantly lesser in patients with a pseudonormal pattern of diastolic function. Increased LVIDD and LVIDS signify dilatation of LV and decreased LVIDD and LVIDS signify reduced compliance of LV.

In addition to revealing a prevalence of LVDD of 62%, this study also unmasked a significant number of subjects (18%) with a pseudonormal pattern of diastolic filling by use of  $\Delta d$  for evaluation of diastolic dysfunction like previous studies.

The recognition of pseudonormal pattern is important because it is considered an intermediary stage between impaired relaxation and restrictive filling.

The frequency of isolated diastolic heart failure in elderly hypertensive patients suggests that asymptomatic hypertensive patients with diastolic dysfunction may be at risk of progression to diastolic heart failure.

## CONCLUSION:

Ambulatory hypertensive cases had an abnormality in diastolic function as assessed by transmitral Doppler signals (E/A ratio). The comparison of transmitral flow and pulmonary vein flow patterns indicates that more cases with normal transmitral flow pattern (56%) had abnormal pulmonary venous Doppler analysis ( $\Delta d$ ) (18%). The current study demonstrated that the presence of LV diastolic dysfunction in hypertensive patients is greater than previously reported by studies that analysed transmitral flow velocity curves alone. To avoid overlooking patients with diastolic dysfunction, the combined analysis of transmitral and pulmonary venous flow velocity curves are recommended.

- The majority were males (58%)
- The abnormal diastolic function as assessed by abnormal E/A ratio was seen in 44% of cases.
- There was a preponderance of female sex in this abnormal diastolic function group.
- Diastolic blood pressure was significantly associated with diastolic dysfunction.
- Abnormal  $\Delta d$  was found in 18% of cases out of 56% who had a normal E/A ratio. These cases are said to have a pseudonormal pattern of diastolic function.
- Both decreased and increased diastolic blood pressure was negatively and positively associated with diastolic dysfunction.
- The diastolic dysfunction was seen in patients with LVH, however, this is statistically not significant indicating LVH is not the only cause for diastolic dysfunction in hypertensives.
- LVIDS and LVIDD were decreased in the pseudonormal group and increased in the abnormal group indicating reduced compliance and dilatation of LV respectively.
- The current study demonstrated that the presence of LV diastolic dysfunction in hypertensive patients is greater than previously reported by studies that analysed transmitral flow velocity curves.

## REFERENCES:

1. Ibrahim MM, Damasceno A: Hypertension in developing countries. *Lancet* 2012; 380:611.
2. Mancia G, Fagard R, Narkiewicz K, Redon J, Zanchetti A, Bohm M, et al. 2013 ESH/ESC guidelines for the management of arterial hypertension: the task force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). *Eur Heart J* 2013;34:2159-219.
3. Owan TE, Hodge DO, Herges RM, et al: Trends in prevalence and outcome of heart failure with preserved ejection fraction. *N Engl J Med* 355:251, 2006.
4. Bhatia RS, Tu JV, Lee DS, et al: Outcome of heart failure with preserved ejection fraction in a population-based study. *N Engl J Med* 355:260, 2006.
5. Siu-hinwan, mark W, Hornig H. Pre-clinical diastolic dysfunction. *JACC*. 2014 Feb 11, vol.63 (no.5,2014): p407-16.
6. Lam CS, Lyass A, Kraigher-Krainer E, et al. Cardiac dysfunction and noncardiac dysfunction as precursors of heart failure with reduced and preserved ejection fraction in the community. *Circulation* 2011;124:24-30.

7. Grossman W: Pressure measurement. In Grossman W, Baim DS (eds): *Cardiac Catheterization, Angiography, and Intervention*. 7th ed. Philadelphia, Lea & Febiger, 2006, p 13.
8. Masutani S, Little WC, Hasegawa H, et al: Restrictive left ventricular filling pattern does not result from increased left atrial pressure alone. *Circulation* 117:1550, 2008.
9. Steinberg BA, Zhao X, Heidenreich PA, et al: Trends in patients hospitalized with heart failure and preserved left ventricular ejection fraction: Prevalence, therapies, and outcomes. *Circulation* 126:65, 2012.
10. Sherif-Nagueh, chair, Christopher P, Thierry C, gillebert, Paolo N, Marino, Jae. K et al. Recommendations for the evaluation of left ventricular dysfunction by Echocardiography. *JASE*, 2009 Feb, vol.22 (no.2):P 107-33.