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Study Of Clinical Profile, 2d Echo Evaluation And Serum Nt Pro Bnp Levels In Patients Diagnosed With Heart Failure With Preserved Ejection Fraction

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ABSTRACT

Introduction: Heart failure is a complex clinical syndrome that results from any structural or functional impairment of ventricular filling or ejection of blood leading to cardinal manifestations of dyspnea, fatigue, and fluid retention. Heart failure with preserved ejection fraction **(**HFpEF) denotes the signs and symptoms of clinical heart failure in a patient with a normal LVEF(>50%) and LV diastolic dysfunction. B-type natriuretic peptide (BNP) is a natriuretic hormone initially identified in the brain but released primarily from the heart, particularly the ventricles. The release of NT Pro BNP is increased in heart failure (HF), as ventricular cells are recruited to secrete BNP in response to the high ventricular filling pressures. This study was conducted with aim of evaluating clinical profile, 2D echo cardiography and to assess the serum NT PRO BNP values among patients with HFpEF**.**

Materials: An observational cross sectional study was conducted in tertiary care medical college situated in South India. The study period was between December 2023 and May 2024. A semi structured questionnaire for was used to collect clinical profile. Also, 2D echo cardiography was performed and serum NT pro BNP levels was measured. Data was entered in MS Excel and analyzed using SPSS Software version 26. Descriptive statistics was used to present the results.

Results: A total of 50 study subjects were included in the study. The mean age of the study participants was 61.45±12.36 years. More than $3/5^{th}$ of the participants were females. Nearly half (48%) of them were in grade 2 diastolic dysfunction. The proportion of NT pro BNP levels are significantly elevated in HFpEF.

Conclusion: our study showed higher serum NT pro BNP level with majority of grade 2 diastolic dysfunction. Further exploration is needed in HFpEF with analytical research.

Keywords: Heart failure, Preserved ejection fraction, BNP levels, 2 D Echo

Introduction

Heart failure (HF) is a clinical syndrome marked by fluid retention, fatigue, and dyspnea, or shortness of breath at normal or low levels of exertion. Since HF is characterized by centrally impaired heart function, as the name suggests,

pump dysfunction has historically been indicated by the ejection fraction (EF), which is low in dilated hearts with reduced systolic performance. EF is the percentage of blood volume ejected with each beat. Heart failure (HF) was recognized as a clinical syndrome 25 years ago, resulting from reduced ejection fraction (HFrEF), which was an indication of left ventricular (LV) systolic dysfunction.[1]It has long been recognized that elevated natriuretic peptide (NP) concentration and left ventricular (LV) diastolic dysfunction have a negative prognostic significance in heart failure patients with reduced ejection fraction. But more than 50% of patients with symptoms of heart failure have an EF that is preserved. It is now evident, nevertheless, that HF can manifest in a variety of ways, and that many HF patients actually have preserved EF.[2,3]Crucially, HFpEF is becoming more common, and its morbidity, mortality, and medical expenses are comparable to those of HFrEF.[4]

An acute or persistent increase in the cardiac filling pressure is the hallmark of HFpEF, a heterogeneous syndrome arising from various aetiologies. Diastolic heart failure (DHF), also known as HF with preserved LVEF, is believed to result from anomalies in the diastolic characteristics of the LV. About half of all heart failure patients have diastolic heart failure, also known as heart failure with normal ejection fraction of the left ventricle (HFNEF).[5] Long-term heart failure with a lower ejection fraction can arise from this type of heart failure. Patients with poorer prognoses in HFrEF have impaired diastolic dysfunction and elevated NP concentrations. On the other hand, the prognostic significance of diastolic function and/or NPs is less clear in patients with HFpEF. Particularly, not much is known about HFpEF patients who were admitted to the hospital due to an acute HF episode. [6] The procedure for diagnosing HFNEF has changed, and the diagnostic criteria have recently been updated, as a result of recent developments in our knowledge of diastolic ECHO characters and biomarkers for heart failure. The pulmonary congestion, dyspnea, and edema features.[7] that follow from this high filling pressure resemble typical systolic dysfunction in their presentation. Regretfully, there isn't as much data to support the treatment of patients with diastolic heart failure as there is for heart failure caused by systolic dysfunction because the condition hasn't been thoroughly investigated in as many clinical trials.

Methods

An observational cross sectional study was conducted in tertiary care medical college and hospital located in Chennai, South India. The study period was between December 2023 and May 2024. Based on the finding of prevalence of HFpEF as 13.5% as shown in previous study conducted by Forsyth F et al with a precision of 10 %, 80% power, 95% confidence interval and adding the non-response rate of 10%, the final sample size was estimated to be 50. The study participants were recruited from the general medicine OPD and casualty of the study setting. Only those study subjects who were above 18 years of age, left ventricular ejection fraction of > 50% and suspected clinical diagnosis of heart failure on the basis of Framingham's criteria were included in the study. Those patients who were pregnant, chest wall injuries, sepsis and not willing to give informed consent were excluded from the study. A semi-structured questionnaire was used to collect the detailed clinical history. Physical examination such as height, weight, heart rate, blood pressure and respiratory rate were done for the study subjects. In addition, serum NT pro BNP levels were measured and 2D echo cardiography was performed for the study participants. Standard laboratory operating procedures were maintained for the biochemical analysis.

For the diagnosis of heart failure, Framingham's criteria was used, in which study subjects with the presence of 2 major criteria or 1 major & 2 minor criteria were diagnosed as heart failure. Major criteria includes the following: 1) Acute Pulmonary edema 2) Cardiomegaly 3) Positive Hepato jugular reflux 4) Neck veins distension 5) PND or orthopnea 6) Pulmonary rales 7) Third heart sound(S3 gallop rhythm), 8) Weight loss > 4.5kg in 5 days in response to treatment. Minor criteria includes : 1) Ankle edema 2)Dyspnea on exertion 3) Hepatomegaly 4) Nocturnal cough 5) Pleural effusion 6) Tachycardia. In Echocardiography, HFpEF was diagnosed with the following diagnostic criteria: 1) Left ventricular Ejection fraction >50% 2) Pulmonary arterial systolic pressure > 35 mm Hg 3) Abnormal diastolic dysfunction and elevated filling pressure. In the assessment of NT Pro BNP levels, high specificity for different age groups are as follows: < 50 years- >450 pg/ml, 50-75 years -> 900 pg/ml and > 75 years ->1800 pg/ml. Chest X ray

was also done to identify the features such as Kerley A, B & C lines, Pulmonary edema and cardiomegaly. The collected data on the clinical profile, 2D Echo parameters and NT pro BNP levels was entered in MS Excel and analyzed using SPSS software version 26. Descriptive statistics such as frequency, percentages, mean and standard deviation were used to present the analyzed results with the help of tables and figures.

Results

A total of 50 study subjects were recruited in the present study. The mean age of the study participants was 61.45±12.36 years. Majority of the study subjects were in the age group of 61-70 years (36%), followed by 51-60 years (26%), > 70 years (20%) and 40-50 years (18%) as shown in table 1. In the present study, there was female preponderance in which more than 3/5th of the study subjects were occupied by female gender as shown in Fig 1. Table 2 shows the distribution of various factors for heart failure among the study subjects in which more than 3/5th of them had diabetes (62%) and dyslipidemia (66%). Also, most of the study participants had hypertension (92%) and only 30 % of the study subjects had personal habits of smoking and alcohol drinking.

The various parameters under the physical examination done for the study subjects were illustrated in table 3. Majority of the study subjects had waist hip ratio 0.9 -1.0 (66%), followed by >1.0 (22%) and <0.9 (10%). With regards to body mass index, majority of the study participants were obese (42%), followed by overweight (30%) and normal BMI (26%). Only 2% of the study subjects were underweight. The average values of pulse rate, systolic & diastolic blood pressure and respiratory rate were also given in the table. In Fig 2, the signs and symptoms experienced by the study subjects were illustrated in which most of the subjects (90%) had dyspnea and fatigue. About 56 % of the participants had paroxysmal nocturnal dyspnea and 42 % of the study subjects had pedal edema.

Fig 3 shows the different grades of diastolic dysfunction among the study subjects in which majority (48%) of them had grade 2 diastolic dysfunction, followed by grade 1 (34%) and grade 3 (18%) respectively. The average values of the various characteristics of 2D echocardiography done among the study subjects were summarized in table 5. Fig 4 shows the level of NT pro BNP levels measured in the study subjects in which 55.6% patients of age < 50 years, 61.3% patients of age 50-75 years, 80% patients of age > 75 years show significantly elevated levels. Table 6 shows the mean values of 2D echo parameters among three different grades of diastolic function, in which mean values of E wave and E/A ratio were comparatively higher in grade 3 study group where as the mean values of A wave and DT were higher in grade 2 study group than the other study groups.

Table 1- Age distribution of the study subjects (N=50)

S.No	Age in years	Frequency	Percent
1	40-50	9	18%
2	51-60	13	26%
3	61-70	18	36%
4	>70	10	20%

Table 2- Risk factors for heart failure among the study subjects (N=50)

S. no	Variables	Frequency	Percent
1.	Presence of diabetes	31	62
2	Presence of dyslipidemia	33	66
3	Presence of hypertension	46	92
4	Presence of metabolic syndrome	38	76
5	Alcohol drinking	15	30
6	Smoking	15	30

Table 3- Physical examination parameters among the study subjects (N=50)

S.no	Physical examination	Frequency	Percent
1.	Waist Hip ratio		
	<0.9	5	(10%)
	0.9-1	34	(68%)
	>1	11	(22%)
2	BMI		
	<18.5	1	(2%)
	18.5-24.9	13	(26%)
	25-29.9	15	(30%)
	>30	21	(42%)
		Mean±S.D	
3.	Pulse rate	82.21 ±7.56	
4.	Systolic BP	172.45 ±23.19	
5.	Diastolic BP	106.97 ±11.18	
6.	Respiratory rate	21.23 ±2.13	

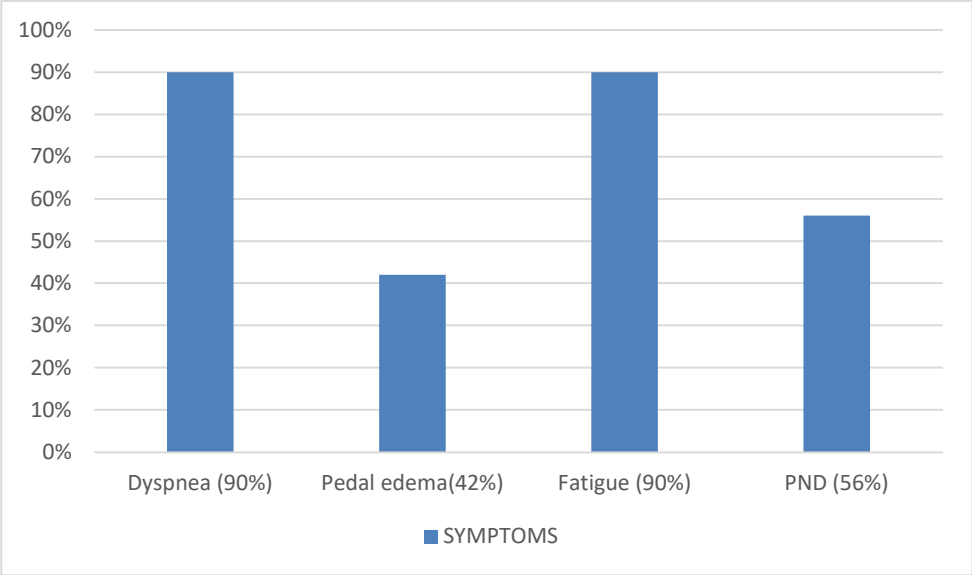

Fig 2- Details of presenting complaints among the study subjects (N=50)

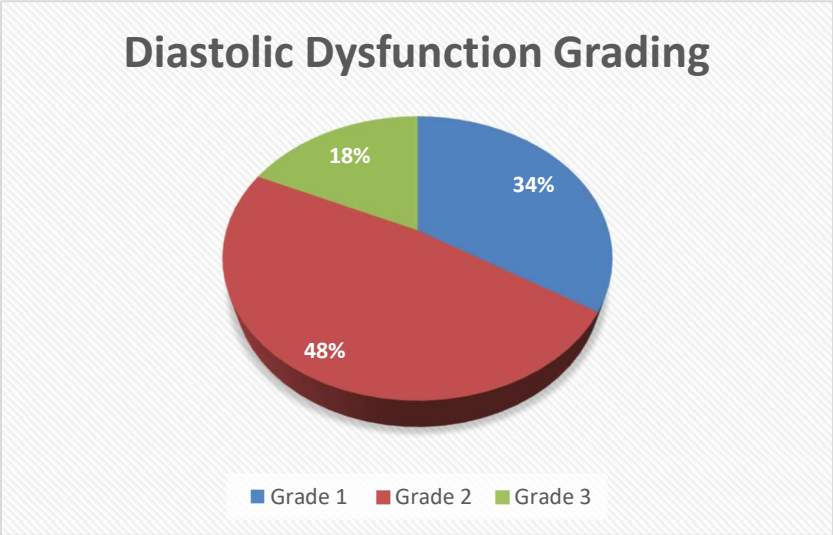

Fig3- Diastolic dysfunction grading among the study subjects (N=50)

Table 4- Mean values of parameters of 2D Echo cardiography done among the study subjects (N=50)

S.No	Echo characteristics	Mean±S.D
1.	E wave m/s	0.87±0.29
2	A wave m/s	0.85±0.11
3	E/A ratio	1.05±0.40
4	DT(ms)	152.99±31.5
5	EF%	51.87±2.56
6	LVEDV	96.67±14.23
7	LVEDV1 ml/m^2	62.78±11.10

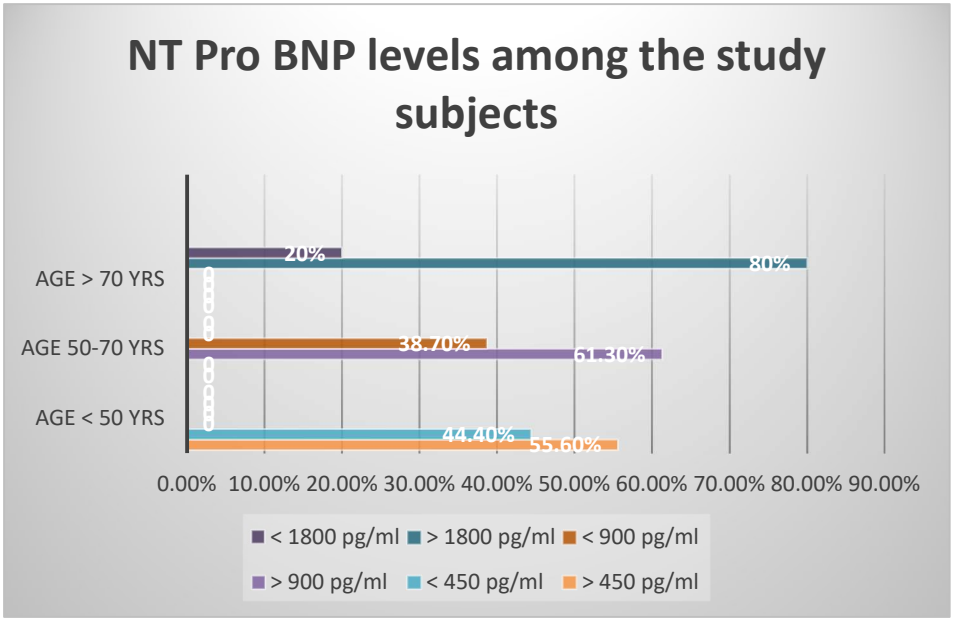

Fig 4- NT pro BNP levels among the study subjects (N=50)

Table 5- Mean values of 2D echo parameters as per 3 different grades of diastolic dysfunction among the study subjects (N=50)

S.No	Echo characteristics	Grade 1 (n=17)	Grade 2 (n=9)	Grade 3 (n=24)
1	E wave	0.56± 0.15	0.97± 0.23	1.22± 0.31
2	A wave	0.88 ±0.16	0.89 ±0.11	0.72 ±0.12
3	E/A ratio	0.65 ±0.04	1.11 ±0.17	1.76 ±0.24
4	DT	166.76± 25.63	163.34± 16.56	101.23± 21.45

Discussion

The current study was conducted with the aim of identifying the clinical profile, estimating the serum NT pro BNP levels and to evaluate the detailed 2D echocardiography among the subjects diagnosed with heart failure with preserved ejection fraction. The mean age of the recruited subjects in the current study was 61.45±12.36 years. The above finding was comparable to a similar observational study conducted by Ammar KA et al[9] in which the mean age

was shown as 60.25±22.45 years. This finding clearly supports the fact that heart failure predominantly occurs in the elderly population.[10] In the present study, female gender preponderance was seen. This inference was supported by a prospective observational study conducted by Peltier, M et al[11] also showed that more than 3/5th of their stud y subjects belonging to female gender. This finding clearly elucidates the female gender as one of the demographic risk-factor for heart failure and it has been reported in various research studies.[12,13]

In the current study, most of the study subjects (92%) had the predominant risk factor of heart failure of hypertension. This finding is supported by a observational study conducted by de Boer AR et al[14] in which more than 4/5th of the research participants were reported with hypertension. In addition, other risk factors such as diabetes, dyslipidemia, metabolic syndrome and personal habits such as alcohol and smoking were reported with remarkable proportions. This observed finding is consistent with a similar cross sectional study conducted by Suna S et al [15]which also showed similar findings.

In the present study, 1/5th of the study participants were reported with waist hip ratio of more than 1 and about 40% of the subjects were found to obese. The above finding is comparable to a similar observational study conducted by Vaduganathan, M et al[16] which also showed similar finding of about 20% of waist hip ratio of >1 and 45% with obese. These inferences strongly support the fact of these two as predominant risk factors for heart failure. In the current study, majority (48 %) of the study subjects were in grade 2 of diastolic dysfunction and also the mean values of A wave and DT were greater in the grade 2 study group than in the other study groups, the mean values of E wave and E/A ratio were relatively higher in the grade 3 study group. These findings are consistent with a study conducted by Shah SJ et al[17].The present study was conducted in a hospital based setting and hence the results observed here cannot be generalized to the whole population in the state or country. In addition, the study design adopted here was cross sectional study in which only the hypothesis can be formulated. And to prove this hypothesis, analytical studies such as case control and cohort study should be performed

Conclusion

Our study showed almost half of the study subjects had grade 2 of diastolic dysfunction. The mean values of A wave and DT was found to be high among subjects with grade 2 diastolic dysfunction and greater E wave & E/A ratio among the participants in grade 3 diastolic dysfunction. Serum NT pro BNP levels are significantly elevated in majority of the patients of HFpEF. Further research in this interest of heart failure with preserved ejection fraction should be encouraged with analytical study designs could help the treating physicians for the effective management of heart failure cases.

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