



Original Research Article

CLINICAL ECHO PROFILE IN HEART FAILURE WITH PRESERVED EJECTION FRACTION

M Ashok Kumar¹, D Giribabu²

¹Professor, Department of General Medicine, Government Medical College, Mancherial, Telangana, India.

²Assistant Professor, Department of General Medicine, Government Medical College, Mancherial, Telangana, India.

Received : 09/05/2025
Received in revised form : 30/06/2025
Accepted : 14/07/2025

Corresponding Author:

Dr. D Giribabu,

Assistant Professor, Department of
General Medicine, Government
Medical College, Mancherial,
Telangana, India.

Email: giridharavath3@gmail.com

DOI: 10.70034/ijmedph.2026.1.442

Source of Support: Nil,

Conflict of Interest: None declared

Int J Med Pub Health

2026; 16 (1); 2554-2561

ABSTRACT

Background: Aim: To study about the clinical Features and Echocardiographic features of patients with Heart Failure with Preserved Ejection Fraction.

Materials and Methods: It was a prospective observational study. The present study includes Patients who are admitted in SVS medical college and hospital, Mahbubnagar with signs and symptoms of heart failure. Patients with LV Ejection fraction >45-50%.

Results: In the present study, the male to female ratio in this study is 1.4:1. Additionally, there was a modest male preponderance in each age group. Overall In the study, 94.23% of patients had hypertension, which was followed by dyslipidemia in 67.31% of cases, diabetes in 61.54% of cases, and metabolic syndrome in 76.92% of cases. In HFpEF, the LVEDD was 46.72 ± 6.42%, the LVESD was 30.12 ± 4.66%, and the LVEF was 63.2% ± 8.1%. In HFPEF, LAE was the main manifestation in the ECG (68%) and there was 56% evidence of IHD. The third most frequent symptom was LVH (44%). HFPEF had AF (not significantly) at 10%, LBBB at 12%, and RBBB at 4%. (not significant).

Conclusion: The present study concluded that HFpEF due to left ventricular diastolic dysfunction is very common in both community and hospital settings. It is associated with morbidity and mortality approximately equal to that of HFrEF but is much harder to diagnose because of the complexity of interpretation of diastolic function on echocardiography. Increased awareness of this condition among the public, as well as within primary healthcare, is essential to halt the global epidemic of HFpEF. Identifying individuals who are at risk of developing this condition and effecting prevention using education, physical exercise and aggressive risk factor control are the keys to achieving this goal.

Keywords: HFrEF, Morbidity, IHD, ECG, LVH, LVEF.

INTRODUCTION

Heart failure is an epidemic disease which affects about 1% to 2% of the population worldwide. Both, the etiology and phenotype of heart failure differ largely.^[1]

According to the European Society of Cardiology (ESC 2016), heart failure is a clinical syndrome marked by typical symptoms (such as dyspnea, ankle swelling, and fatigue) that may be accompanied by signs (such as elevated jugular venous pressure, pulmonary crackles, and peripheral oedema). These symptoms are brought on by a structural and/or functional cardiac abnormality, which results in a

reduced cardiac output and/or elevated intracardiac pressures at rest or during stress.^[2]

Heart failure is characterised as a pathological condition where the heart is either unable to pump blood at the rate needed by the tissues that are metabolising it or can only do so with a raised filling pressure.

Based on the left ventricular ejection fraction, the condition is split into subgroups (LVEF). Heart failure with reduced ejection fraction is when the LVEF is less than 40%. (HFrEF). This distinction between patients with an LVEF greater than 40% (referred to as heart failure with mildly reduced EF, or HFmrEF), and greater than 50% (referred to as heart failure with preserved EF, or HFpEF), is the

result of clinical trials evaluating therapeutic interventions in these patients using discrete LVEF cut-offs as inclusion/exclusion criteria.^[3,4]

The syndrome of heart failure (HF) with maintained ejection fraction (EF) has acquired significant awareness, despite the fact that historically, "pump failure" or having a reduced left ventricular (LV) ejection fraction (EF) had been regarded to characterise HF (HFPEF). The most exhaustive standards for characterising the syndrome of HFPEF are the recommendations of the Heart Failure and Echocardiography Associations of the European Society of Cardiology.

Three major mechanisms that are implicated in the patho-physiology of chronic heart failure

- a) Impaired myocardial contractility- systolic dysfunction.
- b) Inadequate or impaired filling of the cardiac chambers- diastolic dysfunction.
- c) Non physiologic changes in cardiac volume, mass, and geometry pathological remodelling.^[6]

Patients with chronic HF can be divided into two broad categories, classified based on characteristic changes in cardiovascular structure and function:

- a) Reduced left ventricular ejection fraction [LVEF] is a sign of systolic heart failure (SHF), which is also characterised by increasing chamber dilatation and eccentric remodelling.
- b) Diastolic heart failure (DHF), which is characterised by problems in diastolic function, normal LV volume, concentric remodelling, and normal LV chamber systolic characteristics.^[5]

Diastolic heart failure (DHF) is diastolic dysfunction, with normal or nearly normal left ventricular (LV) ejection fraction, and symptoms and indications of HF are all present in the same patient (eg, abnormal left ventricular filling and elevated filling pressures). Diastolic heart failure (DHF), often known as "heart failure with normalejection fraction," is the name given to this condition (HFNEF). Congestive failure in these patients is primarily caused by diastolic dysfunction.^[5]

The ACC/AHA criteria for DHF should be understood to not call for an echocardiographic DD diagnosis. It has been proposed that the simple symptom of HF with maintained LVEF should be adequate to establish the diagnosis of DHF because the echocardiographic characteristics of DD are potentially difficult to interpret and user-dependent.^[6] The amount of neurohormones (norepinephrine) and natriuretic peptides (such NT-pro BNP) rises as a sign of cellular malfunction. Noninvasive (echocardiography, NMR, NT-pro BNP) and invasive (heart catheterization, biopsy) diagnostic techniques are used to diagnose heart failure.

Despite having extremely similar signs, symptoms, and prognoses, the clinically overt DHF and SHF appear to be 2 different syndromes with discrete morphologic and functional alterations.^[6,7]

Diastolic heart failure is the term used to describe the syndrome of clinical heart failure without cardiac valve abnormalities and normal left ventricular systolic performance (DHF).

The clinical symptoms that show in HFpEF and HFrEF are comparable, although HFpEF has slightly lower mortality than HFrEF. While a variety of treatments are effective for HFrEF, none have been demonstrated to increase survival in HFpEF.^[6,7]

Aim and Objectives

1. To study about the clinical Features of patients with Heart Failure with Preserved Ejection Fraction.
2. To study about the Echocardiographic features of Heart Failure with Preserved Ejection Fraction.

MATERIALS AND METHODS

Study design of the topic

Prospective observational study

Inclusion Criteria

1. Patients who are admitted in SVS medical college and hospital, Mahbubnagar with signs and symptoms of heart failure
2. Patients with LV Ejection fraction >45-50%

Exclusion Criteria

3. Heart failure patients with EF<45% any time during their clinical course.
4. Patients who underwent cardiac surgeries (CABG, valve repair, etc).
5. Chest wall injuries (blunt/penetrating).

Sample size and duration of the study

50 consecutive patients who presented to us in OPD and casualty of SVS medical college and hospital for a duration of 24 months.

Source of the data

Cases presented at OPD and casualty of SVS hospital, Mahbubnagar

Investigations Required

1. Complete blood picture
2. ECG
3. Chest X-ray
4. Random Blood sugar
5. Blood urea, serum creatinine, serum electrolytes
6. Fasting lipid profile

2DECHO

Statistical Method: Continuous data were expressed as mean±SD (i.e. Age, SBP, DBP, LVEDD, LVESD and EF), age distribution between males and females compared with X² Test (Chi Square Test). P=0.05 Just Significant (JS) P<0.05 Significant (S), P<0.001 – Highly Significant (HS).

RESULTS

50 Patients of Heart failure with Preserved Ejection Fraction (EF ≥50%)

Table 1: Age and Sex Distribution

	Female	Male	Total
No of cases	20	30	50
Percentage	40%	60%	100%

In the total heart failure cases 20(40%) were females and 30 (60 %) were males among the total 50 cases.

Table 2: Age and Sex Distribution

AGE (YEARS)	No of cases with PRESERVED EF ≥ 50% (N= 50)					
AGE (YEARS)	MALE	MALE (%)	FEMALE	FEMALE (%)	TOTAL	TOTAL (%)
25-35	4	13.3%	3	15.0%	7	14.0%
36-45	8	26.7%	6	30.0%	14	28.0%
46-55	8	26.7%	3	15.0%	11	22.0%
56-65	6	20.0%	4	20.0%	10	20.0%
66 & above	4	13.3%	4	20.0%	8	16.0%
TOTAL	30	100.0%	20	100.0%	50	100.0%
MEAN Age (years)	52.88 ± 11.18		53.6 ± 11.88			
MEAN Age (years)	53.78 ± 10.56					

Table 3: Symptoms Profile

CLINICAL FEATURES	HF PRESERVED EF ≥ 50% (N= 50)	HF PRESERVED EF ≥ 50% PERCENTAGE	P Value	Significance
Breathlessness	38	76.0%	P <0.001	HighlySignificant
Orthopnea	24	48.0%	P <0.05	Significant
H/O Oedema	14	28.0%	P=0.05	Just Significant
Palpitation	40	80.0%	P <0.001	HighlySignificant
Chest Pain	21	42.0%	P=0.05	Just Significant

Table 4: Clinical Signs in Patients with HF Preserved EF ≥ 50% (N= 50).

CLINICAL SIGNS	HF PRESERVED EF ≥ 50%(N= 50)	HF PRESERVED EF ≥ 50% PERCENTAGE	P Value	Significance
Pedal Edema	14	28.0%	P=0.05	Just Significant
JVP	34	68.0%	P<0.001	Highly Significant
LV-S3	0	0.0%	P>0.05	Not Significant
Murmur	0	0.0%	P>0.05	Not Significant
Rales	38	76.0%	P<0.001	Highly Significant
Hepatomegaly	8	16.0%	P>0.05	Not Significant
PULSE AF	6	12.0%	P>0.05	Not Significant
PULSE ST	18	36.0%	P<0.001	Highly Significant
PULSE VPC	5	10.0%	P>0.05	Not Significant
PULSE NORMAL	5	10.0%	P>0.05	Not Significant
SBP	150.20 ±18.44			
DBP	90.2 ± 28.32			

Rales in the lung fields was present in 100% of HF patients and Elevated JVP was the 2nd most common sign. Mean SBP was 150.2 ±18.4 mmHg and Mean DBP was 90.2 ±28.32 mmHg in HFPEF.

Table 5: Major risk factors in patients with HF preserved EF ≥ 50% (N= 50)

RISK FACTORS	HF PRESERVED EF ≥ 50%(N= 50)	HF PRESERVED EF ≥ 50%PERCENTAGE	P Value	Significance
SystemicHypertension	44	88.0%	P<0.001	Highly Significant
Diabetes Mellitus	7	38.9%	P=0.05	Just Significant
Coronary Artery Disease	3	16.7%	P>0.05	Not Significant
Alcoholism	4	22.2%	P>0.05	Not Significant
Smoking	3	16.7%	P>0.05	Not Significant

Systemic hypertension (SHT) – 88% was the most common risk factor in HFPEF followed by Diabetes mellitus (DM) -39 %.Alcoholism (22%) and smoking and CAD 16.7% each were significant risk factors in HFPEF

Table 6: ECG features in patients with HF preserved EF ≥ 50% (N= 50)

ECG Features	HF PRESERVED EF ≥ 50% (N=50)	HFPRESERVED EF ≥ 50% PERCENTAGE	P Value	Significance
LVH	22	44.0%	P<0.05	Significant
LAE	34	68.0%	P<0.001	Highly Significant
AF	5	10.0%	P>0.05	Not Significant
LBBB	6	12.0%	P>0.05	Not Significant

RBBB	2	4.0%	P>0.05	Not Significant
IHD	28	56.0%	P<0.05	Significant

Table 7: Chest X-ray findings in patients with HF preserved EF \geq 50% (N= 50)

CHEST X-RAY FINDINGS	HF PRESERVED EF \geq 50% (N= 50)	HF PRESERVED EF \geq 50% PERCENTAGE	P Value	Significance
Cardiomegaly	9	18.0%	P=0.05	Just Significant
Pulm.VHT	34	68.0%	P<0.0001	More Significant
PleuralEffusion	0	0.0%	P>0.05	Not Significant

Table 8: Echocardiographic features in patients with HF Preserved EF \geq 50% (N= 50)

ECHOCARDIOGRAPHIC FEATURES	HFPRESERVED EF \geq 50% (N= 50)	HFPRESERVED EF \geq 50% PERCENTAGE	P Value	Significance
Hypokinesia	28	56.0%	P < 0.05	Significant
DD	44	88.0%	P<0.0001	Highly Significant
SD	23	46.0%	P>0.05	Not Significant
Normal (without	17	34.0%	P>0.05	Not Significant

DISCUSSION

Ejection fraction is thought to be preserved in about half of all HF patients. Recently, there has been a lot of research done on the risk factors, clinical characteristics, pathophysiology, and course of the illness. In the current series, 50 heart failure patients who met the Framingham criteria and were admitted to the general medical ward in SVS medical college and hospital between September 2020 and September 2022 were examined.

The majority have shown that there are little differences in clinical symptoms, signs, and radiographic findings, and they have established that none of the clinical features may be utilised to distinguish patients with HFPEF. To diagnose HFPEF, evaluation of EF by cardiac imaging is also required.

The current study can be viewed as an examination of the clinical trajectory of HF with preserved in the disease assessment.

AGE & SEX

Mean age of no. of Heart failure cases with preserved Ejection Fraction \geq 50% (HFPEF) (n= 50). Mean age of distribution in HFPEF was 53.78 ± 10.56 yrs.

The majority of the instances in the study group were from people over 50 years old, although 14 cases (28%) were from people between the ages of 36 and 45. Ages 46 to 55 made approximately 22% of the cases. 10 instances (20%) were observed in the 56-65 year old age group, while 8 cases (16%) were observed in the over 66 year old age group.

In total, 75% of the research group's patients were over 50. Out of 5, 60% of the patients were men and only 40% were women. Therefore, men made up the bulk of the patients. According to the results of numerous research, patients with HFNEF are more likely to be older women.

Relationship between congestive heart failure in elderly people and left ventricular systolic function. They came to the conclusion that death rates are

higher and HFpEF prevalence is higher among the elderly.

The prevalence and outcomes of HFpEF were examined by Owan TE et al,^[3] in their research. They came to the conclusion that there had been a noticeable trend over the previous 15 years toward increased proportions among heart failure patients with normal ejection fraction, even though the mortality rate had remained the same, underscoring the significance of this expanding public health issue. In the I-PRESERVE and Candesartan in Heart Failure: Assessment of Reduction in Mortality and Morbidity (CHARM)-Preserved patients, 29% had a history of AF. In elderly IPRESERVE patients with a median age of 75 and 82 years, respectively, the prevalence of AF was 44% and 51%.

Patients hospitalised for acutely decompensated HFpEF also frequently have 219 AF. Even if the LV systolic function has returned, AF may still exist because to underlying diastolic dysfunction.^[8]

In contrast to Theophilus E. Owan et al investigations, AF did not demonstrate significance in HFPEF (9%) or HFrEF (7%) but did in HFPEF (41%). The most important risk variables for both forms of heart failure were SHT, CAD, and DM. Alcoholism and smoking were not significant in HFPEF, but significant in HFrEF, 59 whereas Vasani et al studies concluded that no significant difference between the two types of heart failure. Vasani et al studies showed mean SBP was 143 ± 24 mmHg and DBP was 73 ± 13 mmHg in HFPEF whereas present study showed mean SBP was 148 ± 15 mmHg and mean DBP was 90 ± 25 mmHg in patients with HFPEF. Patients with HFrEF had mean SBP 120 ± 10 mmHg, mean DBP 80 ± 15 mmHg.^[9]

90% of patients with HFrEF and 48% of those with HFPEF had ECG evidence of IHD, respectively. There was strong evidence of LAE in both forms of heart failure. In both forms of heart failure, AF, RBBB, and LBBB were not significant. Compared to 87% in HFrEF, pulmonary venous hypertension was observed in the CXR of 72% of patients with HFPEF.

Pleural effusion and cardiomegaly were both quite substantial in HFrEF.

the United States' national health and nutrition survey, which shows Heart failure prevalence increases with age, going from 1% in those aged 25 to 54 to 4.5% in people aged 65 to 74. It is most likely connected to 10% in more than 75 years. According to a research by Kannel et al., the incidence of CHF doubles with each decade of age in the Framingham study, with only a tiny male preponderance. Thus, people aged 85 to 94 had the highest incidence of HF. The incidence increased from 0.02/1000 population per year in those aged 25 to 40 to 11.6/1000 population in those aged 85 and over in the Hillington research by Cowrie et al., however the median age at presentation was 76 years.

The male to female ratio in this study is 1.4:1. Additionally, there was a modest male preponderance in each age group in the Kannel et al. Framingham study.^[8,10]

Male to female incidence ratio in Cowie et al Hillington's study was 1.75. In this study, breathlessness was a common presenting symptom in 94% of participants. Orthopnoea (48%) was the most prevalent symptom, per the Framingham study.

The majority of patients in the Bursi et al. research (67.53%) had HFrEF and 32.47% had HFpEF. In HFpEF, 60% of the population was female and 40% was male; in HFrEF, the ratio was 71.15% male to 28.84% female. Males had higher rates of HFrEF while females had higher rates of HFpEF.^[11]

A study by Bhatia et al. found that similar to our findings, HFpEF was present in 76% of the patients. However, 55% of patients in the Bursi et al. research had HFpEF. 10 In this study, both HFpEF and HFrEF were more prevalent in males (71.15%, $p=0.0025$) and females (60%) respectively. In contrast to the notion that HF is more common in males, this study and the studies mentioned above confirm that patients with HFpEF are more likely to be female.

CLINICAL FEATURES

The most prevalent presenting symptoms in HF were palpitations (80%), exertional breathlessness (76%) and orthopnea (48%) respectively. Leg edoema in the HFPEF was 28%.

SIGNS

Elevated JVP was the second most frequent symptom, while Rales in the Lung Fields were seen in 100% of HF patients. In HFPEF, the mean SBP was 150.2 ± 18.4 mmHg and the mean DBP was 90.2 ± 28.32 mmHg.

RISK FACTORS

The most prevalent risk factor in HFPEF was Systemic Hypertension (SHT) (88%), followed by Diabetes Mellitus (DM) (39%). Significant risk factors for HFPEF were alcoholism (22%), smoking (16.7%), and CAD.

The participants in this cross-sectional observational study all had heart failure with a normal ejection fraction and were all part of the same group. The risk factor profiles of patients with varying degrees of

diastolic dysfunction were compared (Grade 1, 2 & 3).

Overall In the study, 94.23% of patients had hypertension, which was followed by dyslipidemia in 67.31% of cases, diabetes in 61.54% of cases, and metabolic syndrome in 76.92% of cases. Alcohol, smoking, and obesity were all observed in 42.31% and 30.77% of cases, respectively. 14 patients (77%) with grade I diastolic dysfunction had hypertension. 100% of individuals with grade II diastolic dysfunction had high blood pressure. Additionally, all 9 individuals with grade III diastolic dysfunction had high blood pressure. ($p=0.0195$) This was statistically significant. 66.67% of individuals with grade I diastolic dysfunction reported dyslipidemia. 53.85% of patients with grade II diastolic dysfunction and all 9 patients with grade III diastolic dysfunction had dyslipidemia; this link was also statistically significant ($p=0.0447$).

18 patients in our study had grade I diastolic dysfunction, and 33.33% of these patients were obese. Grade II diastolic dysfunction was present in 25 patients, 34.62% of whom were obese. This correlation was statistically significant ($p=0.0437$) in the 9 patients with grade III diastolic dysfunction who were also 77.78% obese.

CLINICAL SIGNIFICANCE IN PATIENTS WITH HF PRESERVED EF LESS THAN 50% (N=50).

Elevated JVP was the second most frequent symptom, while Rales in the Lung Fields were seen in 100% of HF patients. In HFPEF, the mean SBP was 150.2 ± 18.4 mmHg and the mean DBP was 90.2 ± 28.32 mmHg.

ANTHROPOMETRY

The patients were 156.63 ± 10.42 cm tall on average. The patients' average weights were 70.19 ± 17.51 kg. The measured average BMI was 28.19 ± 3.99 kg/m². BSA on average was 1.70 ± 0.26 . Male patients' average height, weight, BMI, and BSA were 165.90 ± 8.45 , 81.36 ± 20.22 , 29.09 ± 4.95 , and 1.88 ± 0.27 , respectively.

Female patients' average height, weight, BMI, and BSA were 149.83 ± 5.10 , 62.87 ± 8.87 , 27.52 ± 3.02 , and 1.56 ± 0.12 , respectively. The study group's average hip circumference was 95.88 cm, the mean waist measurement of the patients was 91.85 cm, and the waist to hip ratio was 0.95 cm, on average. We discovered a statistically significant correlation between increasing Grade of Diastolic Dysfunction and increasing BMI ($p=0.036$) & W/H ratio ($p=0.012$).

HF PRESERVED EF 50% PATIENTS WITH CHEST X-RAY FINDINGS (N=50).

The Highly Significant finding in EF Preserved HF was pulmonary venous HT. 18% of people had cardiomegaly, and there was no pleural effusion.

CHARACTERISTICS OF ECHO

The average E wave for Grade 1 DD is 0.57 m/s, the average A wave is 0.88 m/s, the average E/A ratio is 0.65 m/s, and the average deceleration time is 166.83 m/s. The average E wave for Grade 2 DD is 0.98 m/s,

the average A wave is 0.89 m/s, the average E/A ratio is 1.10 m/s, and the average deceleration time is 163.36 m/s. The average E wave for Grade 3 DD is 1.23 m/s, the average A wave is 0.71 m/s, the average E/A ratio is 1.76 m/s, and the average deceleration time is 101.67 m/s.

The study's overall average A wave speed was 0.86 m/s. The reported mean E/A ratio was 1.06. DT (in ms) was 153.88 on average. Our investigation was useful in delineating the anthropometric variability, demographic profile, clinical presentation, risk factors, and ECHO features related with increasing Grade of Diastolic Dysfunction.

In HFpEF, the left ventricle's hypokinesia was 55.6%. A whopping 88% of HFpEF contained DD. The majority of patients (46% in HFpEF) had SD. No DD or SD was present in 34% of HF patients with an EF below 50%. In HFpEF, the LVEDD was 46.72 ± 6.42%, the LVESD was 30.12 ± 4.66%, and the LVEF was 63.2% ± 8.1%.

The median N-terminal pro-brain natriuretic peptide level was 918 pg/ml (interquartile range: 485 to 1,578 pg/ml), 94% of patients had hypertension, 53% of patients were female, the average age was 74.8 years, and 35% of patients had atrial fibrillation. The prevalence of LV hypertrophy was 21%, that of left atrial enlargement was 83%, that of increased E/e' ratio was 53%, and that of pulmonary hypertension was 31%. The mean left ventricular (LV) ejection fraction was 58.6 ± 9.8%. 288 patients experienced heart failure hospitalisation or cardiovascular mortality over the median follow-up of 2.8 years. Higher LV mass index (hazard ratio [HR]: 1.05 per 10 g/m²; 95% confidence interval [CI]: 1.00 to 1.10; p = 0.03 in fully adjusted models), E/e' ratio (HR 1.04 per unit; 95% CI 1.02 to 1.06; p 0.001), pulmonary artery systolic pressure (HR 1.51 per 10 mm Hg; 95% CI 1.29 to 1.76; p 0.001), and right ventricular end-diastolic area (HR 1.04 per cm²; 95% CI 1.01 to 1.07; p = 0.003) were all linked with this composite. Despite identical E/e' ratios, pulmonary artery systolic pressures, and event rates compared to other HFpEF clinical studies, significant changes in cardiac anatomy were found. Within six months of enrolment, 1,097 of 4,822 patients with PARAGON-HF had echocardiography.^[12]

Heart failure with recovered ejection fraction^{2,3,17} or heart failure with better ejection fraction^{4,23} have been used to describe the subset of patients with HFpEF who previously had HFrEF in a number of publications, and different EF cut-off points (40%, 45%, 17 and 50%) have been used to define this HF category. According to the current guidelines for the management of heart failure, we utilised the definition of heart failure with improved ejection fraction in this article with a cut-off point of >40%. Patients with HFNEF were examined using echocardiography by Michael R. Zile et al. in order to evaluate the following parameters for diastolic function. mainly

1. Left ventricular dimension.
2. Left ventricular wall thickness.

3. Transmitral flow velocities (E/A ratio).
4. Wall motion abnormalities.

The patients in the current investigation were likewise assessed using the aforementioned metrics, however cardiac catheterization was not done due to insufficient facilities. HF PRESERVED EF 50% IN PATIENTS WITH ECHOCARDIOGRAPHIC FEATURES (N=50). In HFpEF, the LVEDD was 46.72 ± 6.42%, the LVESD was 30.12 ± 4.66%, and the LVEF was 63.2% ± 8.1%. ECG CHARACTERISTICS: In HFPEF, LAE was the main manifestation in the ECG (68%) and there was 56% evidence of IHD. The third most frequent symptom was LVH (44%). HFPEF had AF (not significantly) at 10%, LBBB at 12%, and RBBB at 4%. (not significant).

CONCLUSION

Any attempt at clinical classification is, by essence, arbitrary. Nevertheless, defining clinical phenotypes in HFpEF may help the management of patients with HFpEF and possibly lead to therapeutic progress. Elderly patients with long-standing hypertension and HFpEF are likely to benefit from a different therapeutic approach than middle-aged obese HFpEF patients. Patients who seek medical attention for PH-related symptoms are clearly in need of specific therapy. When HFpEF and CAD coexist, great attention needs to be given to both conditions.

Last, HFpEF is associated with a multitude of comorbid conditions that require specific therapies. HFpEF due to left ventricular diastolic dysfunction is very common in both community and hospital settings. It is associated with morbidity and mortality approximately equal to that of HFrEF but is much harder to diagnose because of the complexity of interpretation of diastolic function on echocardiography. A high index of clinical suspicion is required. Delay in diagnosis leads to advanced disease with a poor prognosis, while early detection may allow treatment of underlying causes. Clinical clues as well as echocardiography should be used for early diagnosis of this condition. Increased awareness of this condition among the public, as well as within primary healthcare, is essential to halt the global epidemic of HFpEF. Identifying individuals who are at risk of developing this condition and effecting prevention using education, physical exercise and aggressive risk factor control are the keys to achieving this goal.

Conflict of Interest: None

Funding Support: Nil

REFERENCES

1. Schwinger RHG. Pathophysiology of heart failure. *Cardiovasc Diagn Ther.* 2021 Feb;11(1):263-276. doi: 10.21037/cdt-20-302. PMID: 33708498; PMCID: PMC7944197.
2. Ponikowski P, Voors AA, Anker SD, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The Task Force for the diagnosis and

- treatment of acute and chronic heart failure of the European Society of Cardiology (ESC) Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. *Eur Heart J* 2016;37:2129-200. 10.1093/eurheartj/ehw128
3. Joergensen ME et al. Characteristics and prognosis of heart failure with improved compared with persistently reduced ejection fraction – A systematic review and meta-analyses. *Eur J PrevCardiol* 2018; 25: 366–376.
 4. Yancy CW, Jessup M, Bozkurt B et al. 2013 ACCF/AHA guideline for the management of heart failure: Executive summary: A report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation* 2013; 128: 1810–1852.
 5. Micha T, Maeder, David M, Kaye: Heart Failure with Normal Left Ventricular Ejection Fraction. *J Am Coll Cardiology* 2009;53:905-918
 6. Wilcox JE, Yancy CW. Heart failure—a new phenotype emerges. *JAMA Cardiol* 2016; 5: 507–509.
 7. Kalogeropoulos AP, Fonarow GC, Georgiopoulou V et al. Characteristics and outcomes of adult outpatients with heart failure and improved or recovered ejection fraction. *JAMA Cardiol* 2016; 1: 510–518.
 8. Chatterjee K, Massie B. Systolic and diastolic heart failure: differences and similarities. *J Card Fail*. 2007 Sep; 13 (7) : 569 - 76 .doi: 10 . 1016 /j.cardfail.2007.04.006. PMID: 17826648.
 9. Aziz F, Tk LA, Enweluzo C, Dutta S, Zaem M. Diastolic heart failure: a concise review. *J Clin Med Res*. 2013 Oct;5(5):327-34. doi: 10.4021/jocmr1532w. Epub 2013 Aug 5. PMID: 23986796; PMCID: PMC3748656.
 10. <https://www.ahajournals.org/doi/10.1161/CIRCRESAHA.12.1318172>
 11. Lee DS, Gona P, Vasan RS, et al. Relation of disease pathogenesis and risk factors to heart failure with preserved or reduced ejection fraction: insights from the Framingham Heart Study of the National Heart, Lung, and Blood Institute. *Circulation*. 2009;119(24):3070-3077.
 12. Yancy CW, Jessup M, Bozkurt B, et al. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *J Am CollCardiol*. 2013;62(16):e147-e239.
 13. Vasan RS, Levy D: Defining diastolic heart failure: a call for standardized diagnostic criteria. *Circulation* 2000;101:2118-21.
 14. Zile MR, Gaasch WH, Carroll JD, et al. Heart Failure with Normal Ejection Fraction: Is measurement of Diastolic function Necessary to make the Diagnosis of Diastolic Heart Failure?. *Circulation* 2001;104:779-782
 15. Guo L, Guo X, Chang Y, Yang J, Zhang L, Li T, Sun Y. Prevalence and risk factors of heart failure with preserved ejection fraction: a population-based study in Northeast China. *Int J Environ Res Public Health* 2016;13:770.
 16. Groenewegen A, Rutten FH, Mosterd A, Hoes AW. Epidemiology of heart failure. *Eur J Heart Fail*. 2020 Aug;22(8):1342-1356. doi: 10.1002/ehf.1858. Epub 2020 Jun 1. PMID: 32483830; PMCID: PMC7540043.
 17. Lee ET, Welty TK, Fabsitz R, Cowan LD, Le NA, Oopik AJ, Cucchiara AJ, Savage PJ, Howard BV. The Strong Heart Study. A study of cardiovascular disease in American Indians: design and methods. *Am J Epidemiol*. 1990 Dec;132(6):1141-55. doi: 10.1093/oxfordjournals.aje.a115757. PMID: 2260546.
 18. Smith GL, Masoudi FA, Vaccarino V, Radford MJ.: Outcomes in Heart Failure patients with Preserved Ejection Fraction: mortality, readmission, and functional decline. *J Am Coll Cardiology* 2003;41:1510-1518
 19. McMurray JJ, Adamopoulos S, Anker SD, et al. ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2012: The Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology Developed in collaboration with the Heart Failure Association (HFA) of the ESC. *European heart journal*. 2012;33:1787–1847. [PubMed] [Google Scholar] [Ref list]
 20. Steinberg BA, Zhao X, Heidenreich PA, Peterson ED, Bhatt DL, Cannon CP, et al. Trends in patients hospitalized with heart failure and preserved left ventricular ejection fraction: prevalence, therapies, and outcomes. *Circulation*. 2012;126(1):65–75. [PubMed] [Google Scholar] [Ref list]
 21. Kitzman DW, Gardin JM, Gottdiener JS, Arnold A, Boineau R, Aurigemma G, Marino EK, Lyles M, Cushman M, Enright PL. Importance of heart failure with preserved systolic function in patients > or = 65 years of age. CHS Research Group. *Cardiovascular Health Study*. *Am J Cardiol*. 2001;87:413–419. doi:10.1016/S0002-9149(00)01393-X. [PubMed] [Google Scholar]
 22. Devereux RB, Roman MJ, Liu JE, Welty TK, Lee ET, Rodeheffer R, Fabsitz RR, Howard BV. Congestive heart failure despite normal left ventricular systolic function in a population-based sample: the Strong Heart Study. *Am J Cardiol*. 2000;86:1090–1096. doi:10.1016/S0002-9149(00)01165-6. [PubMed] [Google Scholar]
 23. Ceia F, Fonseca C, Mota T, Morais H, Matias F, de Sousa A, Oliveira A. Prevalence of chronic heart failure in Southwestern Europe: the EPICA study. *Eur J Heart Fail*. 2002;4:531–539. doi:10.1016/S13
 24. Owan TE, Hodge DO, Herges RM, Jacobsen SJ, Roger VL, Redfield MM. Trends in prevalence and outcome of heart failure with preserved ejection fraction. *N Engl J Med*. 2006;355:251–259. doi:10.1056/NEJMoa052256. [PubMed] [Google Scholar]
 25. Huffman MD, Berry JD, Ning H, Dyer AR, Garside DB, Cai X, Daviglius ML, Lloyd-Jones DM. Lifetime risk for heart failure among white and black Americans: cardiovascular lifetime risk pooling project. *J Am Coll Cardiol* 2013;61:1510–1517. [PMC freearticle] [PubMed] [Google Scholar]
 26. Rapsomaniki E, Timmis A, George J, Pujades-Rodriguez M, Shah AD, Denaxas S, White IR, Caulfield MJ, Deanfield JE, Smeeth L, Williams B, Hingorani A, Hemingway H. Blood pressure and incidence of twelve cardiovascular diseases: lifetime risks, healthy life- years lost, and age-specific associations in 1.25 million people. *Lancet* 2014;383:1899–1911.
 27. Christiansen MN, Køber L, Weeke P, Vasan RS, Jeppesen JL, Smith JG, Gislason GH, Torp-Pedersen C, Andersson C. Age-specific trends in incidence, mortality, and comorbidities of heart failure in Denmark, 1995 to 2012. *Circulation* 2017;135:1214–1223. [
 28. Conrad N, Judge A, Tran J, Mohseni H, Hedgecott D, Crespillo AP, Allison M, Hemingway H, Cleland JG, McMurray JJ, Rahimi K. Temporal trends and patterns in heart failure incidence: a population-based study of 4 million individuals. *Lancet* 2018;391:572–580.
 29. Shah RU, Klein L, Lloyd-Jones DM. Heart failure in women: epidemiology, biology and treatment. *Womens Health (Lond)* 2009;5:517–527.
 30. Porek L, Laule-Kilian K, Christ A, Klima T, Pfisterer ME, Perruchoud AP, Mueller C. Coronary artery disease and outcome in acute congestive heart failure. *Heart*. 2006 May;92(5):598-602.
 31. A Randomized Trial of Intensive versus Standard Blood-Pressure Control. *N Engl J Med*. 2017 Dec 21;377(25):2506.
 32. Tschope C., Birmir C., Bohm M., Bruder O., Frantz S., Luchner A., Maier L., Stork S., Kherad B., Laufs U. Heart failure with preserved ejection fraction: Current management and future strategies: Expert opinion on the behalf of the Nucleus of the “Heart Failure Working Group” of the German Society of Cardiology (DKG) *Clin. Res. Cardiol*. 2018;107:1–19. doi: 10.1007/ s00392-017-1170-6. [PubMed] [CrossRef] [Google Scholar] [Ref list]
 33. “Heart left ventricular hypertrophy sa” By Patrick J. Lynch, medical illustrator – Patrick J. Lynch, medical illustrator .
 34. Simmonds, Steven J, et al. “Cellular and Molecular Differences between HFpEF and HFrEF: A Step Ahead in an Improved Pathological Understanding.” *Cells*, MDPI, 18 Jan. 2020,
 35. <https://www.acc.org/education-and-meetings/products-and-resources/features/global-cv-institute/heart-failure-guidelines>

36. Cleland JG, Pellicori P, Dierckx R. Clinical trials in patients with heart failure and preserved left ventricular ejection fraction. *Heart Fail Clin.* 2014;10:511–523. [PubMed] [Google Scholar]
37. Zile MR, Gaasch WH, Carroll JD, Feldman MD, Aurigemma GP, Schaer GL, Ghali JK, Liebson PR. Heart failure with a normal ejection fraction: is measurement of diastolic function necessary to make the diagnosis of diastolic heart failure? *Circulation.* 2001;104:779–782. [PubMed] [Google Scholar]
38. Braunwald E. The Path to an Angiotensin Receptor Antagonist-Nephrilysin Inhibitor in the Treatment of Heart Failure. *J. Am. Coll. Cardiol.* 2015;65:1029–1041. doi:S0735-1097(15)00292-2 [pii];10.1016/j.jacc.2015.01.033 [doi]
39. Plotnikov A., Zehorai E., Procaccia S. and Seger R. : "The MAPK cascades: signaling components, nuclear roles and mechanisms of nuclear translocation". *BiochimBiophys Acta* 2011; 1813: 1619.
40. Chen F., Yang J., Li Y., Wang H. Circulating microRNAs as novel biomarkers for heart failure. *Hellenic J. Cardiol.* 2018;59:209–214. doi: 10.1016/j.hjc.2017.10.002
41. He J, Ogden LG, Bazzano LA, et al. Risk factors for congestive heart failure in US men and women: NHANES I epidemiologic follow-up study. *Arch InternMed* 2001;161:996-1002. 10.1001/archinte.161.7.996
42. Borlaug BA, Melenovsky V, Russell SD, et al. Impaired chronotropic and vasodilator reserves limit exercise capacity in patients with heart failure and a preserved ejection fraction. *Circulation* 2006;114:2138–47. 10.1161/CIRCULATIONAHA.106.632745 [PubMed] [CrossRef] [Google Scholar] [Ref list]
43. van Heerebeek L, Borbely A, Niessen HW, et al. Myocardial structure and function differ in systolic and diastolic heart failure. *Circulation* 2006;113:1966-73. 10.1161/CIRCULATIONAHA.105.587519 [PubMed] [CrossRef] [Google Scholar] [Ref list]
44. Kehat I, Molkentin JD. Molecular pathways underlying cardiac remodeling during pathophysiological stimulation. *Circulation* 2010;122:2727-35. 10.1161/CIRCULATIONAHA.110.942268
45. Schwinger RHG. Pathophysiology of heart failure. *Cardiovasc DiagnTher.* 2021 Feb;11(1):263-276. doi: 10.21037/cdt-20-302. PMID: 33708498; PMCID: PMC7944197.
46. Haydock PM, Flett AS Management of heart failure with reduced ejection fraction *Heart* 2022;108:1571-1579.
47. Samson R, Jaiswal A, Ennezat PV, Cassidy M, Le Jemtel TH. Clinical Phenotypes in Heart Failure With Preserved Ejection Fraction. *J Am Heart Assoc.* 2016 Jan 25;5(1):e002477. doi: 10.1161/JAHA.115.002477. PMID: 26811159; PMCID: PMC4859363.
48. Ponikowski P, van Veldhuisen DJ, Comin-Colet J, Ertl G, Komajda M, Mareev V, McDonagh T, Parkhomenko A, Tavazzi L, Levesque V, Mori C, Roubert B, Filippatos G, Ruschitzka F, Anker SD., CONFIRM-HF Investigators. Beneficial effects of long-term intravenous iron therapy with ferric carboxymaltose in patients with symptomatic heart failure and iron deficiency†. *Eur Heart J.* 2015 Mar 14;36(11):657-68. [PMC free article] [PubMed] [Reference list]
49. Mant J, Doust J, Roalfe A, Barton P, Cowie MR, Glasziou P, Mant D, McManus RJ, Holder R, Deeks J, Fletcher K, Qume M, Sohanpal S, Sanders S, Hobbs FD. Systematic review and individual patient data meta-analysis of diagnosis of heart failure, with modelling of implications of different diagnostic strategies in primary care. *Health Technol Assess.* 2009 Jul;13(32):1-207, iii.
50. Gimelli A, Lancellotti P, Badano LP, Lombardi M, Gerber B, Plein S, Neglia D, Edvardsen T, Kitsiou A, Scholte AJ, Schröder S, Cosyns B, Gargiulo P, Zamorano JL, Perrone-Filardi P. Non-invasive cardiac imaging evaluation of patients with chronic systolic heart failure: a report from the European Association of Cardiovascular Imaging (EACVI). *Eur Heart J.* 2014 Dec 21;35(48):3417-25.
51. Paterson I, Mielniczuk LM, O'Meara E, So A, White JA. Imaging heart failure: current and future applications. *Can J Cardiol.* 2013 Mar;29(3):317-28.
52. Butler J. The emerging role of multi-detector computed tomography in heart failure. *J Card Fail.* 2007 Apr;13(3):215-26
53. ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines. *Circulation.* 2013 Oct 15;128(16):e240-327.
54. Rakowski H, Appleton C, Chan KL, Dumesnil JG, Honos G, Jue J, Koilpillai C. et al. Canadian consensus recommendations for the measurement and reporting of diastolic dysfunction by echocardiography: from the Investigators of Consensus on Diastolic Dysfunction by Echocardiography. *J Am Soc Echocardiogr.* 1996;9(5):736–760.
55. Henein MY, Gibson DG. Suppression of left ventricular early diastolic filling by long axis asynchrony. *Br Heart J.* 1995;73(2):151–157.
56. Oki T, Tabata T, Yamada H, Wakatsuki T, Shinohara H, Nishikado A, Iuchi A. et al. Clinical application of pulsed Doppler tissue imaging for assessing abnormal left ventricular relaxation. *Am J Cardiol.* 1997;79(7):921–928
57. McDonagh TA, Metra M, Adamo M, et al. 2021 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur Heart J* 2021;42:3599–726. doi:10.1093/eurheartj/ehab368 pmid:http://www.ncbi.nlm.nih.gov/pubmed/34447992
58. SPRINT Research Group. Wright JT, Williamson JD, Whelton PK, Snyder JK, Sink KM, Rocco MV, Reboussin DM, Rahman M, Oparil S, Lewis CE, Kimmel PL, Johnson KC, Goff DC, Fine LJ, Cutler JA, Cushman WC, Cheung AK, Ambrosius WT. A Randomized Trial of Intensive versus Standard Blood-Pressure Control. *N Engl J Med.* 2015 Nov 26;373(22):2103-16. [PMC free article] [PubMed]
59. Pradhan A, Vohra S, Vishwakarma P, Sethi R. Review on sodium-glucose cotransporter 2 inhibitor (SGLT2i) in diabetes mellitus and heart failure. *J Family Med Prim Care.* 2019 Jun;8(6):1855-1862. [PMC free article] [PubMed]
60. CONSENSUS Trial Study Group. Effects of enalapril on mortality in severe congestive heart failure. Results of the Cooperative North Scandinavian Enalapril Survival Study (CONSENSUS). *N Engl J Med.* 1987 Jun 04;316(23):1429-35. [PubMed]
61. SOLVD Investigators. Yusuf S, Pitt B, Davis CE, Hood WB, Cohn JN. Effect of enalapril on survival in patients with reduced left ventricular ejection fractions and congestive heart failure. *N Engl J Med.* 1991 Aug 01;325(5):293-302. [PubMed]
62. McMurray JJ, Packer M, Desai AS, Gong J, Lefkowitz MP, Rizkala AR, Rouleau JL, Shi VC, Solomon SD, Swedberg K, Zile MR., PARADIGM-HF Investigators and Committees. Angiotensin-neprilysin inhibition versus enalapril in heart failure. *N Engl J Med.* 2014 Sep 11;371(11):993-1004. [PubMed]
63. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JG, Coats AJ, Falk V, González-Juanatey JR, Harjola VP, Jankowska EA, Jessup M, Linde C, Nihoyannopoulos P, Parissis JT, Pieske B, Riley JP, Rosano GM, Ruilope LM, Ruschitzka F, Rutten FH, van der Meer P., Authors/Task Force Members. Document Reviewers. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC). Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. *Eur J Heart Fail.* 2016 Aug;18(8):891-975. [PubMed]