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Advances in HFpEF Management (AHM)

(CKM Navigation)

A Textbook of Cardiology

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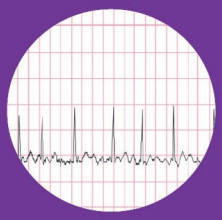
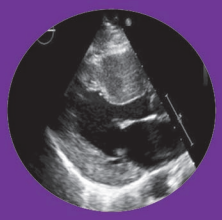
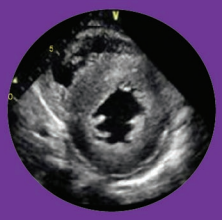
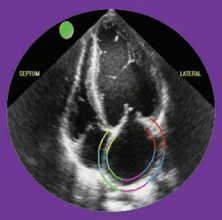
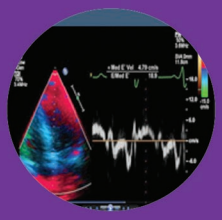


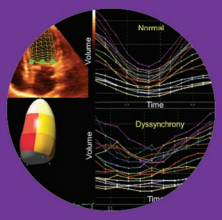




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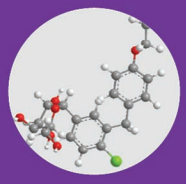
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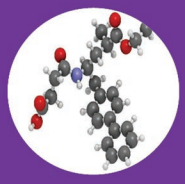
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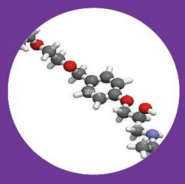
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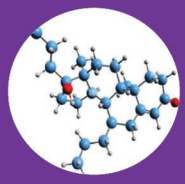
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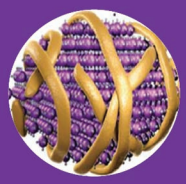
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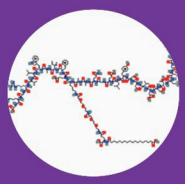
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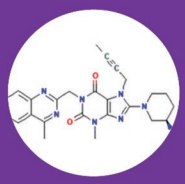
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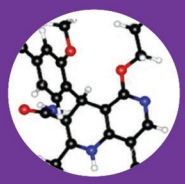
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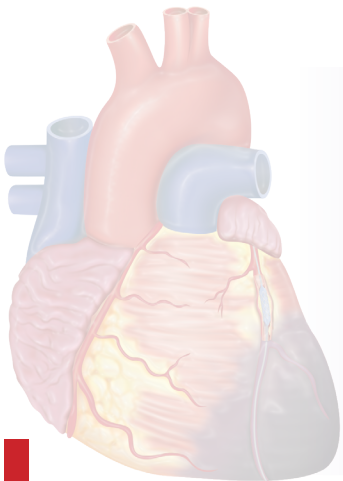

Indian Heart Failure Registries: Focusing on HFpEF

Richard Raj R, Harikrishnan S

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INTRODUCTION

The heart failure with preserved ejection fraction (HFpEF) burden is rising probably due to an increase in prevalence and possibly due to increased case detection rates. We know that the diagnostic criteria for HFpEF is constantly evolving and yet to get settled.[1] However, in countries like India, many cases may be missed due to a lack of awareness about the condition among both patients and healthcare providers.

The clinical presentation of HFpEF makes routine diagnostic approaches less yielding as the symptoms are very atypical and nonspecific. We also now have the information that there are different phenotypic spectra in HFpEF which actually are yet to be characterized clearly. So, there is an increasing focus on individualized medicine in HFpEF, considering the varying patient characteristics and comorbidities. The refinement of algorithms for diagnosis and treatment plans has been ongoing for a long time. Moreover, the epidemiological data on HFpEF from India is scarce. Here is a look at HFpEF in the Indian context, focusing on its prevalence, unique challenges, and considerations.

HFpEF IN INDIA—EPIDEMIOLOGY—ARE WE MISSING CASES? WHY?

All the major registries from India have shown the prevalence of HFpEF is <20% **(Table 1)**. The first HF registry from India, the Trivandrum HF registry which recruited patients in 2013 showed a prevalence of 16%.[2] The Kerala HF registry which recruited patients in 2018 showed a prevalence of 15% and the National HF registry (2019–20) showed a prevalence of 13% only. In contrast, the *Indus (India-UKieri) study* by Vivek Chaturvedi et al.,[3] screened just over 10,000 adults across six villages which were the peripheral centers of the All-India Institute of Medical Sciences (AIIMS), New Delhi. Those who had shortness of breath for >6 months were included and the heart failure burden amounted to 1.2/1,000 population, out of which two-thirds were HFpEF.

TABLE 1: Heart failure with preserved ejection fraction (HFpEF) prevalence across various registries in India.

	HFrEF <40%	*HFmrEF 40–49%*	*HFpEF = ≥50%*
NHFR (*n* = 10,851)	65%	22%	13%
THFR (*n* = 1,205)	62%	22%	16%
KHFR (*n* = 7,512)	67%	18%	15%
ICC-HF registry (*n* = 5,269)	68%		32% (>40%)

(HFmrEF: heart failure with mid-range or mildly reduced ejection fraction; HFrEF: heart failure with preserved ejection fraction; ICC-HF: Indian College of Cardiology-Heart Failure; KHFR: Kerala Acute Heart Failure Registry; NHFR: National Heart Failure Registry; THFR: Trivandrum HF registry)

The reasons for the low prevalence of HFpEF could be manyfold. The most important is that probably many cases are missed. The lack of awareness among patients and physicians might also contribute to this issue. Since HFpEF has nonspecific symptoms such as pedal edema and dyspnea, patients may be treated for asthma, and many with diuretics alone. The lack of awareness among physicians when patients are labeled as normal when

seeing normal ejection fraction also may contribute to the issue. The elaborate and not-so-easy diagnostic criteria is another factor that adds to the missing of cases. Even experienced echocardiographers find it difficult to assess the patient with all the recommended parameters. In a busy echo room in India, it is not practically possible to perform such an elaborate and time-consuming echo evaluation. It is high time that we develop some simple echo criteria to diagnose HFpEF. The diastolic stress test which is recommended is difficult to perform and facilities for such evaluation are limited in Indian hospitals. Invasive cardiac catheterization facilities are not available in most of the hospitals and those who have the facility do not have trained people to accurately assess the patient and interpret the results. The universal definition of HF has mandated natriuretic peptide (NP) levels in the diagnosis of HF. As we know NP tests are not available in all health facilities in India, and it is too costly. That also may be a factor in missing the cases.

HFpEF "A DISEASE OF COMORBIDITIES"

Most of the patients with HFpEF present with the backdrop of one or more comorbidities, often poorly controlled with medications due to various reasons **(Fig. 1)**. The higher baseline blood pressure (BP) levels in the aging population as studied by Agrawal et al., from Odisha, based on the insights from SAGE wave-2 (Study on global aging and adult health) (2015–16) study[4] aggravated by poor adherence to medications, and more importantly, by the failure to monitor the BP periodically to dose adjust these medications to target levels. In addition to these, the higher body mass index (BMI) associated

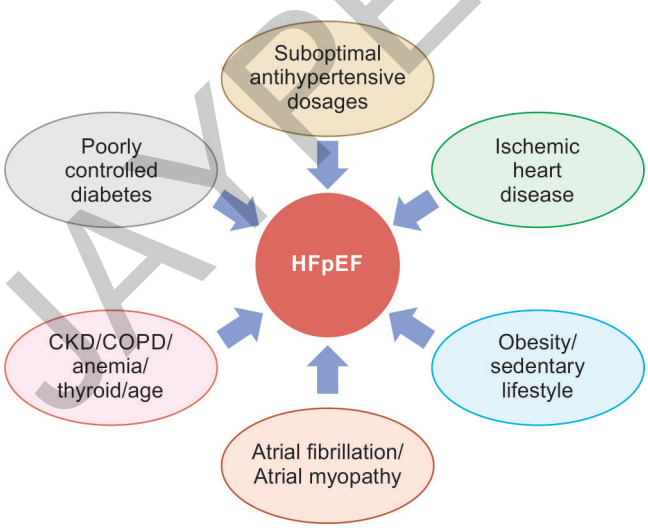

Fig. 1: Causative factors of heart failure with preserved ejection fraction (HFpEF) in Indian background.

with the aging Indian population was shown in a meta-analysis by Daniel et al. from the All-India Institute for Medical Science, New Delhi, which comprised a total of 60,006 participants.[5] The pooled prevalence of overweight/obesity among elderly persons in India was 21.5% (95% confidence interval: 17.1–26.2%) which significantly worsened their functional status, probably as a result of the sedentary lifestyle with a lack of regular physical activity and poor diet habits, although this does not correlate exactly with the NT-proBNP levels that might remain falsely low despite worsening symptoms.[6]

PHENOTYPES OF HFpEF

The HFpEF represents a heterogeneous syndrome with different clinical phenotypes which will help in identifying patients at a higher risk of HF hospitalizations and in tailoring the follow-up for that individual. HFpEF clinical phenogroups from the TOPCAT (Treatment of Preserved Cardiac Function Heart Failure with an Aldosterone Antagonist Trial) participants were classified into three.[7] Phenogroup 1 exhibited younger age, higher smoking prevalence, preserved functional class, and the least evidence of left ventricular (LV) hypertrophy, and arterial stiffness. Phenogroup 2 was older, with normotrophic concentric LV remodeling, atrial fibrillation, left atrial enlargement, large-artery stiffening, and innate immunity and vascular calcification biomarkers. Phenogroup 3 demonstrated more functional impairment, obesity, diabetes, chronic kidney disease, concentric LV hypertrophy, high renin, and biomarkers of tumor necrosis factor-alpha–mediated inflammation, liver fibrosis, and tissue remodeling. Compared with phenogroup 1, phenogroup 3 exhibited the highest risk of the primary endpoint of cardiovascular death, heart failure hospitalization, or aborted cardiac arrest. Phenogroups 2 and 3 demonstrated similar all-cause mortality. Spironolactone randomized therapy was associated with a more pronounced reduction in the risk of HF hospitalization and mortality in phenogroup 3 comparatively.

Similarly, a cluster model from the Swedish Heart Failure Registry (Swede HF)[8] identified five distinct clusters: cluster 1 (10% of patients) were young patients with a low comorbidity burden and the highest proportion of implantable devices; cluster 2 (30%) patients had atrial fibrillation, hypertension without diabetes; cluster 3 (25%) patients were the oldest with many cardiovascular comorbidities and hypertension; cluster 4 (15%) patients had obesity, diabetes and hypertension; and cluster 5 (20%) patients were older with ischemic heart disease, hypertension, and renal failure and were most frequently

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prescribed diuretics. Patients in cluster 1 had the best prognosis, while patients in clusters 3 and 5 had the worst age- and sex-adjusted prognosis.

Interestingly, Shah et al., have also classified HFpEF into seven phenotypes based on the etiology.[9] (1) "garden variety" HFpEF, associated with a lot of comorbidities; (2) CAD-associated HFpEF; (3) atrial fibrillation-predominant HFpEF; (4) right heart failure-predominant HFpEF; (5) hypertrophic cardiomyopathy-induced or hypertrophic-cardiomyopathy-like HFpEF; (6) multivalvular HFpEF; and (7) restrictive cardiomyopathies such as cardiac amyloidosis.

All the aforementioned studies have inferred that the higher the comorbidity burden, as commonly seen in the Indian population, the higher the mortality and heart failure hospitalization. Also, the effectiveness of spironolactone in reducing the risk is of notable importance.

MORTALITY WITH HFpEF

The Western data had shown that HFpEF and HFrEF mortality are similar, especially by Tsao et al. from Boston who studied the temporal trends in the incidence and mortality-associated with heart failure with preserved and reduced ejection fraction.[10] Across the two decades, the HF incidence rate ratio was similar. During follow-up after HF, 67.4%; died [HFrEF (33%), HFpEF (29%)]. There were no significant differences in mortality rates (overall, CVD, and non-CVD) across decades within HF subtypes, nor between HFrEF and HFpEF within the decade. But the data from India showed different numbers.

Short-term Mortality

The Cardiology Society of India-Kerala Acute Heart Failure Registry (CSI-KAHFR)[11] published in the year 2021, the majority of whom were HFrEF (67.5%), while a nearly equal number of patients have HFmrEF (17.6%) and HFpEF (14.9%). The mean age was 64 ± 12.9 years (males 63 ± 12.5 and females 66 ± 13.5) with an overall male predominance (63%), which was marked in HFrEF and HFmrEF groups, while no significant sex difference was noted in the HFpEF group. Coronary artery disease (CAD) being the most common etiology (65.5%). The majority had diabetes mellitus (61.5%) and hypertension (53%). Patients with HFrEF had higher mortality rates (7.7%) compared to those with HFmrEF (5.2%) and HFpEF (5.6%). The 90-day mortality was marginally higher in HFrEF (12.3%; 95% CI: 11.4–13.2) than in HFpEF (10.6%; 95% CI: 8.8–12.5) or HFmrEF (9.9%; 95% CI: 8.5–11.3) (log-rank 0 = 0.022). The mortality per 100 person-days was 15.5% with HFrEF, 12% with HFmrEF, and 13% with HFpEF.

TABLE 2: Mortality differences between heart failure with reduced ejection fraction (HFrEF) and heart failure with preserved ejection fraction (HFpEF) from Indian registries.

	HFrEF	*HFpEF*
CSI-KHFR 90-Day	12.3%	10.6%
NHFR—India	15.7%	12.5%
Asian HF Registry—1 year	10.6	5.4%

(CSI-KHFR: Cardiology Society of India-Kerala Acute Heart Failure Registry; NHFR: National Heart Failure Registry)

Then came the National Heart Failure Registry (NHFR),[12] which included 10,851 patients from 54 centers across 24 states and 2 union territories. This study assessed the clinical profile and 90-day outcome of heart failure patients across various parts of the country and the numbers revealed that the most common presentation was HFrEF in two-thirds (65.2%) of the study population, followed by HFmrEF (22%) and HFpEF (12.7%). Ischemic heart disease was the predominant etiology for HF (72%). Hypertension and diabetes were the most frequently comorbid conditions (48.9% and 42.3%, respectively). Atrial arrhythmia was prevalent in 9.5% of the study population. Chronic kidney disease, stroke, and chronic obstructive pulmonary disease (COPD) were reported in 8.5%, 3.0%, and 6.9% of the study population, respectively. Overall, 90-day mortality was 14.2, it was highest in HFrEF (15.7%) and in HFpEF it was 12.5% **(Table 2)**.

Long-term Mortality

The 5-year data from the Trivandrum Heart Failure Registry (THFR)[2] provided more insights. Out of the 1,205 patients, 59% were males. Hypertension was prevalent in 55% and diabetes in 52% of patients. The predominant group was HFrEF (62%) with HFpEF and HFmrEF comprising 20% and 18%, respectively. The unadjusted 5-year mortality rate was 59% (61.3%, 60.5%, and 46.8% in HFrEF, HFmrEF, and HFpEF groups, respectively). The lowest cumulative incidence rate of mortality was in patients with HFpEF. Patients with HFpEF had a 28% lower 5-year mortality in comparison to HFrEF.

The reasons for low mortality in HFpEF could be many. The lower age of the patients by 10 years may be one factor. The mortality in THFR is mainly cardiovascular—96%—and noncardiovascular mortality is pretty low. HFpEF patients are older, and they may have many comorbidities. They have many patients dying of

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noncardiovascular causes, which may not be the case in this relatively younger cohort from India.

PHARMACOLOGICAL FACETS

Compared to the treatment options available in managing HFrEF, the pharmacological options when it comes to HFpEF are evolving and will continue to evolve in the coming years. The five pillars of managing HFpEF are: treating circulatory congestion by diuretics, controlling comorbidities, using evidence-based drugs, identifying and managing secondary etiologies, and cardiopulmonary rehabilitation, which is not well utilized in the Indian context. When it comes to the Indian population, after adequate optimization of medications in controlling the comorbidities, patients have to be started on the new evidence-based drugs—sodium-glucose co-transporter-2 (SGLT2) inhibitors, mineralocorticoid receptor antagonists (MRAs)—with the recent evidence for Finerenone) provided there are no contraindications for the same. Beyond medications, advanced interventional procedures targeting autonomic modulation, respiratory modulation, electrophysiological modulation, structural interventions targeting interatrial shunting,[13] etc., the data is evolving and is yet to come to regular practice.

WHAT DO THE HEART FAILURE REGISTRIES IN INDIA TEACH US?

The patients with HF were younger than the patients in the high-income countries (HIC) by a decade (mean age; ADHERE registry 74 years, European HFS registry 70 years, and ATTEND registry 73 years). The younger age of onset of illness also points toward the socioeconomic impact of the disease at an individual and community level. Acute HF patients in the subcontinent are predominantly HFrEF. While there are measures that are effective in controlling factors that result in HFrEF, treatment of HFpEF is largely linked to symptomatic measures and management and control of risk factors **(Fig. 2)**.

CONCLUSION

Continued research into the versatile mechanisms of HFpEF and the development of new treatment modalities is vital. Indeed, the past few decades have seen significant improvement in diagnosing and managing HFpEF. The continued research on the complex pathophysiology and advances in molecular biology is likely to identify the key mechanisms in HFpEF development and progression. Research is now strongly focusing on the phenotyping of HFpEF and understanding regional differences in HFpEF prevalence and pathology among different ethnic and socioeconomic subgroups. In most parts of the country, particularly in low-resource settings, access to advanced diagnostic tools and therapies is often limited. Addressing these disparities will be crucial for improving the diagnosis and betterment of outcomes for HFpEF patients in India.

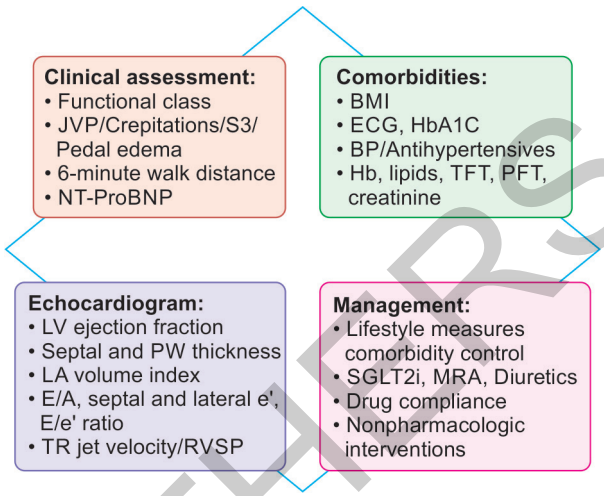

Fig. 2: Heart failure with preserved ejection fraction (HFpEF) evaluation and management algorithm. (BP: blood pressure; ECG: electrocardiography; HbA1C: hemoglobin A1c; JVP: jugular venous pressure; LV: left ventricular; MRA: mineralocorticoid receptor antagonists; NT-proBNP: N-terminal pro B-type natriuretic peptide; RVSP: right ventricular systolic pressure; SGLT2i: sodium-glucose co-transporter-2 inhibitors; THT: thyroid function test; TR: tricuspid regurgitation)

REFERENCES

1. Pillai HS, Ganapathi S. Heart failure in South Asia. Curr Cardiol Rev. 2013;9(2):102-11.
2. Harikrishnan S, Jeemon P, et al. Five-year mortality and readmission rates in patients with heart failure in India: Results from the Trivandrum heart failure registry. Int J Cardiol. 2021;326:139-43.
3. Chaturvedi V, Parakh N, Seth S, et al. Heart failure in India: The INDUS (INDia Ukieri Study) study. J Pract Cardiovasc Sci. 2016;2:28-35.
4. Agrawal R, Murmu J, Sinha A, et al. Association of dietary sodium intake and hypertension among older adults in India: Insights from (Study on global AGEing and adult health) SAGE wave-2, Clinical Epidemiology and Global Health. 2023;23(4):101358.
5. Daniel RA, Kalaivani M, Aggarwal P, et al. Prevalence of overweight/obesity among elderly persons in India: A systematic review and meta-analysis. J Prim Care Spec. 2024;5(1):22-35.

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6. Obokata M, Reddy YNV, Pislaru SV, et al. Evidence supporting the existence of a distinct obese phenotype of heart failure with preserved ejection fraction. Circulation. 2017;136(1):6-19.
7. Cohen JB, Schrauben SJ, Zhao L, et al. Clinical Phenogroups in Heart Failure with Preserved Ejection Fraction. JACC Heart Fail. 2020;8(3):172-84.
8. Uijl A, Savarese G, Vaartjes I, et al. Identification of distinct phenotypic clusters in heart failure with preserved ejection fraction. Eur J Heart Fail. 2021;23(6):973-82.
9. Shah SJ, Katz DH, Deo RC, et al. Phenotypic Spectrum of Heart Failure with Preserved Ejection Fraction. Heart Fail Clin. 2014;10(3):407-18.
10. Tsao CW, Lyass A, Enserro D, et al. Temporal Trends in the Incidence of and Mortality Associated with Heart Failure with Preserved and Reduced Ejection Fraction. JACC Heart Fail. 2018;6(8):678-85.
11. Joseph S, Panniyammakal J, Abdullakutty J, et al. The Cardiology Society of India-Kerala Acute Heart Failure Registry: poor adherence to guideline-directed medical therapy. Eur Heart J. 2022;43:908-15.
12. Harikrishnan S, Bahl A, Roy A, et al. Clinical profile and 90-day outcomes of 10,851 heart failure patients across India: National Heart Failure Registry. ESC Heart Fail. 2022;9(6):3898-908.
13. Shah SJ, Borlaug BA, Chung ES, et al. Atrial shunt device for heart failure with preserved and mildly reduced ejection fraction (REDUCE LAP HF II): a randomized, multicentre, blinded, sham-controlled trial. Lancet. 2022; 399(10330):1130-40.

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It is the first publication of its kind in the form of a textbook of cardiology from India to the world. Over 300 contributors from India and abroad have contributed their prestigious chapters in this book, which focuses on every aspect of heart failure with preserved ejection fraction (HFpEF) management with enormous information about advances in clinical approach, imaging including echocardiography, and multimodality imaging; and drug, mechanical and surgical interventions for better patient care with HFpEF-inflicted morbidity and mortality reduction in various clinical situations and has tremendous innovative and research potential of understanding advances in HFpEF management for the undergraduates, postgraduates, practicing cardiologists, endocrinologists, nephrologists, neurologists, critical care specialists, pulmonologists, pediatricians, pediatric surgeons, physicians, cardiovascular surgeons, imaging experts, nutritionists, etc. The book includes 21 sections and 169 chapters. The book is being dedicated to the Nation and the Cardiological Society of India.



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