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Original Article

A Comparison of Readmission Rates in Heart Failure with Preserved Ejection Fraction (HFpEF) V/S Heart Failure with Reduced Ejection Fraction (HFrEF)

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ABSTRACT

Heart failure (HF) contributes to increased hospital readmissions which results in amplified resource burden and morbidity. The conditions of readmission in HF patients have not been clarified. **Objectives:** To govern the relationship between heart failure with preserved ejection fraction (HFpEF) and heart failure with reduced ejection fraction and correlation with readmissions ratio. **Methods:** This prospective cohort study was held in the Adult Cardiology department of Tabba Heart Institute, Karachi, Pakistan for 6 months from March 10, 2019 to September 9, 2019. After attaining informed consent, an interview and clinical examination were performed and subjects were divided into exposed and unexposed groups (HFpEF and HFrEF). Patients were followed for readmission within one-month of initial hospitalization. **Results:** A total of 162 patients with heart failure (81 patients in each group) were included in the study. The mean total age was 65.4 ± 10.4 years, and 52.5% of the patients were male. Rehospitalization on day 30 was observed in 11 (13.6%) patients from the Group A (HFpEF) and in 10 (12.3%) patients from the Group B(HFrEF). Cardiac readmission was more common in the unexposed group than in the exposed group (80.0% vs. 63.6%). **Conclusions:** After admission due to acute heart failure, patients with HFpEF have a statistically insignificantly higher hospitalization burden compared to patients with HFrEF. In addition, patients with HF with preserved ejection fraction were as likely to be readmitted for cardiovascular reasons as those with HF with reduced ejection fraction.

INTRODUCTION

Heart failure is a well-known clinical condition and the number of hospital admissions with decompensated heart failure is increasing, mainly due to the increasing age of the population [1, 2]. It is estimated to affect 26 million people worldwide, with over one million admissions yearly in both the Europe and United States [3, 4]. In the US, the annual incidence of newly diagnosed heart failure is 670,000 cases per year. It has been reported that between one-third and one-half of HF patients maintain their ejection fraction, and these patients, especially in older age groups, may replace HF patients with reduced ejection fractions [5]. These patients tend to be older and have a different risk factor profile compared to patients with low ejection fraction (HFrEF) and heart failure. The increased incidence and hospitalization rates of subjects with HFpEF also reported higher post-hospital mortality during follow-up compared with HFrEF, but little adjustment was later found for several clinical features [6, 7]. Readmission is a huge financial burden on the health of heart failure patients, especially in a country like ours where the government has no health insurance system [8]. Admission rates also differ in the literature between the two groups; some published studies show similar readmission rates in the short and long term [9]. On the other hand, studies have shown re-hospitalization rates as high as 47% after HF, with or without cardiac causes. A recent follow-up study by

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Caughey *et al*. reports a 42% augmented rehospitalization risk in subjects with HFrEF in comparison with HFpEF after 30 days[5]. Previously, many studies have been conducted in the West to assess the variances in clinical characteristics and patients' outcomes with these two different types of HF, and have shown similar overall mortality and incidence and regional characteristics of HF in Asian countries[10]. However, there have been no local studies evaluating differences in clinical characteristics and treatment outcomes in heart failure patients with preserved and reduced ejection fraction(HFrEF vs HFpEF). Therefore, the goal of this analysis was to assess the differences in clinical features and predictors as well as the rates of rehospitalization in subsequent months among patients presenting with reduced and preserved ejection fraction in Tabba Heart tertiary cardiac care [11, 12]. The adverse clinical consequences of heart failure with preserved and reduced ejection fraction are now well known. Both types of heart failure are equally related to readmission and health economics, but local data are lacking[13, 14]. Our study will explore the relevance of both types of HF by identifying the prevalence and predictors of HFrEF and HFpEF in the local population and differences in readmission rates. Therefore, a better understanding of heart failure and its subtypes of cardiac and non-cardiac failure has the potential to improve survival with heart failure and lead to lower readmission rates.

METHODS

This prospective cohort study was conducted at the Tabba Heart Institute, Department of Adult Cardiology, Karachi, Pakistan, from March 10, 2019 to September 9, 2019. Using the WHO sample size calculator, taking the readmission rate statistics as 23% for heart failure with preserved ejection fraction (HFpEF) and 47% for heart failure with reduced ejection fraction(HFrEF). The confidence interval was 5% and test power as 90%. The calculated sample size turned out to be 81 in each group. The total sample size will be 162. Recruitment and follow-up of all patients, if any, will be conducted throughout the study to compare readmission rates and assess predictors between the two types of heart failure. The admission criteria were,

1. Adult patients of both genders, aged 18 to 80 years, with newly diagnosed heart failure.

Group A: Heart failure with preserved ejection fraction (HFpEF)

Group B: heart failure with reduced ejection fraction (HFrEF)

2. Patients undergoing echocardiography to confirm ejection fraction

Exclusion criteria include, patients with pre-existing heart failure and severe primary valvular disease, and patients who developed heart failure after admission to the hospital (as an in-hospital complication). The study was conducted after obtaining the consent of the CPSP. Tabba Heart Institute ethics committee approval was obtained prior to data collection. The required number of patients who met the inclusion criteria were selected for this study through consecutive sampling from the Department of Adult Cardiology of the Tabba Heart Institute, Karachi, Pakistan. Patient demographic profiles such as age (year), weight (kg), height (cm), gender, hypertension, diabetes, dyslipidemia, family history and smoking history were recorded for all patients. BMI for all enrolled patients was calculated based on weight (kg)/height (m2). Confounding variables and bias were controlled by strict adherence to the inclusion and exclusion criteria during the design and regression phases of the stratification and analysis phases. Patient data is safe and available only to authorized persons. The S.D and mean were calculated for weight, age, BMI and height. Rates and percentages were calculated for gender, diabetes mellitus, dyslipidemia, hypertension, smoking, history of CAD (previous PCI, myocardial infarction, CABG, etc.). Comparison of heart failure with preserved ejection fraction (HFpEF) and rehospitalization was performed using chi -square. A $p \leq 0.05$ will be taken as significant and relative risk will be calculated. Impact modifiers such as age, BMI, dyslipidemia, CAD history(prior MI, PCI, CABG, etc.) were taken into account by stratification. After stratification, the chi-square test will be applied and the relative risk will also be calculated.

RESULT

A total of 162 patients with heart failure were selected for the study and divided into 2 groups as exposed group included patients of Heart failure with preserved ejection fraction and unexposed group include patients with preserved ejection fraction(HFpEF). The overall mean age was 65.4 ± 10.4 years and 52.5% of the patient-years were male and 26.9 ± 5.9 kg/m2 was the mean BMI(Table 1).

	HFpEF (n=81)	HFrEF (n=81)	Total (162)	P-value
Mean Age	68.1 ± 10.5	62.6 ± 9.6	65.4 ± 10.4	0.0006
Mean BMI	28.2 ±6.3	25.6 ±5.4	26.9 ± 5.9	0.004
Gender wise Distribution				
Male	27(33.3)	58(71.6)	85(52.5)	<0.001
Female	54(66.7)	23(28.4)	77(47.5)	
Distribution According to Diabetes Mellitus				
Yes	53(65.4)	44(54.3)	97(59.9)	0.15
No	28(34.6)	37(45.7)	65(40.1)	
Distribution According to Dyslipidemia				
Yes	21(25.9)	20(24.7)	41(25.3)	0.85
No	60(74.1)	61(75.3)	121(74.7)	

Table 1: Mean age, Mean BMI and Distribution of HFpEF and HFrEF according to Gender, Diabetes Mellitus and dyslipidemia.

Of the 81 exposed patients, 27(33.3%) were male with 68.1 ±

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10.5 years of mean age, 58 (71.6%) of the 81 unexposed patients were male with a mean age of 62.6 ± 9. The mean BMI was 28.2 ± 6.3 kg/m2 in the exposed group and 25.6 ± 5.4 kg/m2 in the unexposed group. While 65.4% were diabetic in the exposed group, diabetes was observed in 44 (54.3%) subjects in the unexposed group. While dyslipidemia was observed in 21 (25.9%) patients in the exposed group, dyslipidaemia was observed in 20 (24.7%) patients in the unexposed group. In both exposed and unexposed groups, 88.9% of patients had hypertension. A total of 5 patients had a family history of CAD, 2 (2.5%) cases in the exposed group and 3 (3.7%) cases in the unexposed group (Table 2).

Hypertension	HFpEF (n=81)	HFrEF (n=81)	Total (162)	P-value
Yes	72 (88.9)	72 (88.9)	144 (88.9)	1.00
No	9 (11.1)	9 (11.1)	18 (11.1)	
Distribution according to family history of coronary artery disease (CAD)				
Yes	2 (2.5)	3 (3.7)	5 (3.1)	0.65
No	79 (97.5)	78 (96.3)	157 (96.9)	

Table 2: Distribution of HFpEF and HFrEF according to Hypertension and family history of coronary artery disease (CAD)

Smoking was most frequent in the unexposed group compared to the exposed group (210 vs. 9.9%) (Table 3).

Smoking	HFpEF (n=81)	HFrEF (n=81)	Total (162)	P-value
Yes	8 (9.9)	17 (21.0)	25 (15.4)	0.05
No	73 (90.1)	64 (79.0)	137 (84.6)	
Distribution According to Prior Percutaneous Coronary Intervention (PCI)				
Yes	13 (16.1)	25 (30.9)	38 (23.5)	0.02
No	68 (83.9)	56 (69.1)	124 (76.5)	

Table 3: Distribution of HFpEF and HFrEF according to smoking status and prior percutaneous coronary intervention (PCI)

Prior PCI was higher in the unexposed group in comparison to the exposed group (30.9% vs. 16.1%, respectively). While 20 (24.7%) patients in the exposed group had a history of CABG, 12 (14.8%) patients in the unexposed group had a history of CABG. Rehospitalization was observed after 30 days in 11 (13.6%) patients in the exposed group and in 10 (12.3%) patients in the unexposed group (Table 4).

Prior CABG	HFpEF (n=81)	HFrEF (n=81)	Total (162)	P-value
Yes	20 (24.7)	12 (14.8)	32 (19.7)	0.11
No	61 (75.3)	69 (85.2)	61 (75.3)	
Readmission	**HFpEF (n=81)**	**HFrEF (n=81)**	**P-value**	**R-R**
Yes	11 (13.6)	10 (12.3)	0.81	0.90
No	70 (86.4)	71 (87.7)		

Table 4: Distribution of HFpEF and HFrEF according to coronary artery bypass graft surgery (CABG) and readmission ratio

Cardiac readmission was more common in the HFrEF and HFpEF (80.0% vs. 63.6%) (Figure 1). Age, gender, BMI, smoking status, hemoglobin, prior MI, prior PCI, and atrial fibrillation were significantly associated with HF patients with preserved ejection fraction (p-value ≤0.05). Although no significant association was observed for diabetes, dyslipidemia, hypertension, family history of CAD, prior CABG, CKD, COPD, CVA, asthma, ILD, atrial flutter, in-hospital mortality, and 30-day readmission (p value > 0.05). Age, gender, BMI, smoking status, hemoglobin, prior MI, prior PCI, and atrial fibrillation were significantly associated with HF patients with preserved ejection fraction (p-value ≤0.05). In our study, p < 0.05 was significantly associated with gender, diabetes, dyslipidemia, hypertension, prior MI, prior PCI, prior CABG, and readmission.

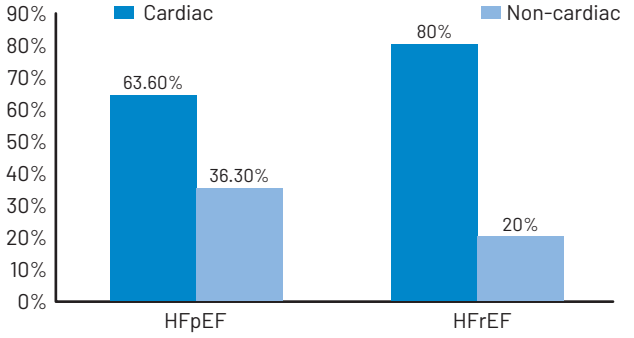

Figure 1: Distribution of HFpEF and HFrEF according to cause of readmission

DISCUSSION

The change of cardiovascular risk factors results in higher incidence of HFPEF in the context of aging and the increasing number of comorbidities [14]. The female gender, increased age, obesity and hypertension are related with HFPEF and these aspects have been shown to have a mechanistic cause [15, 16]. Since we do not understand the relationship between HF type and 30-day readmission rates in the general HF population, we investigated the difference in these outcomes in a prospective study. After adjusting for comorbidity burden, demographics, and BMI, we found that 30-day readmission rates were similar between patients with HFrEF and those with HFpEF [17, 18]. Previous studies of 251 individual populations enrolled in hospitals and regional health organizations had results consistent with our study [19]. Given that HFpEF accounts for approximately half of HF hospitalizations, the results are similar in patients with HFrEF and HFpEF, and there are treatments that improve outcomes for HFpEF but not for HFpEF [20]. In our study, the type of readmission in the exposed group was related to cardiovascular disease in 7 patients (63.6%) and non-cardiovascular in 4 (36.3%) patients, while the type of readmission was related to cardiovascular disease in 8 (72.7%) of patients in the unexposed group. During the 49.5 months of median follow-up, a total of 5,863

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hospitalizations occurred in 2,278 patients [21]. Most hospitalizations for the first time concerned cardiovascular diseases (54%), with the largest percentage being hospitalizations due to heart failure (18%). Worsening HF was the cause of hospitalization with the highest rate (43%) in those with first presentation of HF [22]. The readmitted patients were elder, more often suffered from IHD and most often suffered from diabetes in the study by Goyala *et al*, Loop *et al* [23]. A recent observational study by Caughey *et al*. described a 42% increased risk of readmission in HFrEF patients compared with HFpEF after 30 days [24]. Heart failure with preserved EF is a communal disease, mainly due to hospitalization, has a complex pathophysiology, heterogeneous phenotype, and has a huge impact on mortality and morbidity [5, 25]. Hospitalization is similar to HFREF, accounting for the vast majority of cardiovascular causes [26, 27]. They justify the need to explore new therapeutic strategies to reduce the number of hospitalizations in HFpEF patients [21].

CONCLUSIONS

After admission for acute heart failure, HFpEF patients have a statistically insignificant burden of readmission compared to HFrEF patients. In addition, patients with HF with preserved ejection fraction were as likely to be readmitted for cardiovascular reasons as those with HF with reduced ejection fraction.

Conflicts of Interest

The authors declare no conflict of interest

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REFERENCES

[1] Ho JE, Gona P, Pencina MJ, Tu JV, Austin PC, Vasan RS, *et al*. Discriminating clinical features of heart failure with preserved vs. reduced ejection fraction in the community. European heart journal. 2012 Jul; 33(14): 1734-41. doi: 10.1093/eurheartj/ehs070

[2] Brouwers FP, de Boer RA, van der Harst P, Voors AA, Gansevoort RT, Bakker SJ, *et al*. Incidence and epidemiology of new onset heart failure with preserved vs. reduced ejection fraction in a community-based cohort: 11-year follow-up of PREVEND. European heart journal. 2013 May; 34(19): 1424-31. doi: 10.1093/eurheartj/eht066

[3] Shimokawa H, Miura M, Nochioka K, Sakata Y. Heart failure as a general pandemic in Asia. European journal of heart failure. 2015 Sep; 17(9): 884-92. doi: 10.1002/ejhf.319

[4] Ambrosy AP, Fonarow GC, Butler J, Chioncel O, Greene SJ, Vaduganathan M, *et al*. The global health and economic burden of hospitalizations for heart failure: lessons learned from hospitalized heart failure registries. Journal of the American College of Cardiology. 2014 Apr; 63(12): 1123-33. doi: 10.1016/j.jacc.2013.11.053

[5] Bhatia RS, Tu JV, Lee DS, Austin PC, Fang J, Haouzi A, *et al*. Outcome of heart failure with preserved ejection fraction in a population-based study. New England Journal of Medicine. 2006 Jul; 355(3): 260-9. doi: 10.1056/NEJMoa051530

[6] Owan TE, Hodge DO, Herges RM, Jacobsen SJ, Roger VL, Redfield MM. Trends in prevalence and outcome of heart failure with preserved ejection fraction. New England Journal of Medicine. 2006 Jul; 355(3): 251-9. doi: 10.1056/NEJMoa052256

[7] Nanayakkara S, Patel HC, Kaye DM. Hospitalisation in patients with heart failure with preserved ejection fraction. Clinical Medicine Insights: Cardiology. 2018 Jan; 12: 1-6. doi: 10.1177/1179546817751609

[8] Tsuchihashi-Makaya M, Hamaguchi S, Kinugawa S, Yokota T, Goto, D, Yokoshiki H, *et al*. Characteristics and outcomes of hospitalized patients with heart failure and reduced vs preserved ejection fraction A report from the Japanese Cardiac Registry of Heart Failure in Cardiology (JCARE-CARD). Circulation Journal, 73(10): 1893-1900. doi: 10.1253/circj.CJ-09-0254

[9] Goyal P, Loop M, Chen L, Brown TM, Durant RW, Safford MM, *et al*. Causes and temporal patterns of 30-day readmission among older adults hospitalized with heart failure with preserved or reduced ejection fraction. Journal of the American Heart Association. 2018 Apr; 7(9): e007785.doi: 10.1161/JAHA.117.007785

[10] Lenzen MJ, Scholte op Reimer WJ, Boersma E, Vantrimpont PJ, Follath F, Swedberg K, *et al*. Differences between patients with a preserved and a depressed left ventricular function: a report from the EuroHeart Failure Survey. European heart journal. 2004 Jul; 25(14): 1214-20. doi: 10.1016/j.ehj.2004.06.006

[11] Caughey MC, Sueta CA, Stearns SC, Shah AM, Rosamond WD, Chang PP. Recurrent acute decompensated heart failure admissions for patients with reduced versus preserved ejection fraction (from the Atherosclerosis Risk in Communities Study). The American journal of cardiology. 2018 Jul; 122(1): 108-14. doi: 10.1016/j.amjcard.2018.03.011

[12] Bursi F, Weston SA, Redfield MM, Jacobsen SJ, Pakhomov S, Nkomo VT, Meverden RA, Roger VL. Systolic and diastolic heart failure in the community. Jama. 2006 Nov 8; 296(18): 2209-16. doi: 10.1001/jama.296.18.2209

DOI: https://doi.org/10.54393/pjhs.v3i07.439

[13] Satomura H, Wada H, Sakakura K, Kubo N, Ikeda N, Sugawara Y, *et al*. Congestive heart failure in the elderly: comparison between reduced ejection fraction and preserved ejection fraction. Journal of cardiology. 2012 Mar; 59(2): 215-9.doi: 10.1016/j.jjcc.2011.11.014

[14] Ng TP and Niti M. Trends and ethnic differences in hospital admissions and mortality for congestive heart failure in the elderly in Singapore, 1991 to 1998. Heart. 2003 Aug; 89(8): 865-70. doi: 10.1136/heart.89.8.865

[15] Chong AY, Rajaratnam R, Hussein NR, Lip GY. Heart failure in a multiethnic population in Kuala Lumpur, Malaysia. European journal of heart failure. 2003 Aug; 5(4): 569-74. doi: 10.1016/S1388-9842(03)00013-8

[16] Tseng CH. Clinical features of heart failure hospitalization in younger and elderly patients in Taiwan. European journal of clinical investigation. 2011 Jun; 41(6): 597-604. doi: 10.1111/j.1365-2362.2010.02447.x

[17] Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE, Drazner MH, *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. Journal of the American College of Cardiology. 2013 Oct; 62(16): e147-239. doi: 10.1161/CIR.0b013e31829e8776

[18] Loop MS, Van Dyke MK, Chen L, Brown TM, Durant RW, Safford MM, *et al*. Comparison of length of stay, 30-day mortality, and 30-day readmission rates in Medicare patients with heart failure and with reduced versus preserved ejection fraction. The American journal of cardiology. 2016 Jul; 118(1): 79-85. doi: 10.1016/j.amjcard.2016.04.015

[19] Gottdiener JS, Arnold AM, Aurigemma GP, Polak JF, Tracy RP, Kitzman DW, *et al*. Predictors of congestive heart failure in the elderly: the Cardiovascular Health Study. Journal of the American College of Cardiology. 2000 May; 35(6): 1628-37. doi: 10.1016/S0735-1097(00)00582-9

[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 Jul; 126(1): 65-75. doi: 10.1161/CIRCULATIONAHA.111.080770

[21] Owan TE, Hodge DO, Herges RM, Jacobsen SJ, Roger VL, Redfield MM. Trends in prevalence and outcome of heart failure with preserved ejection fraction. New England Journal of Medicine. 2006 Jul; 355(3): 251-9. doi: 10.1056/NEJMoa052256

[22] Bhatia RS, Tu JV, Lee DS, Austin PC, Fang J, Haouzi A, *et al*. Outcome of heart failure with preserved ejection fraction in a population-based study. New England Journal of Medicine. 2006 Jul; 355(3): 260-9. doi: 10.1056/NEJMoa051530

[23] Liao L, Jollis JG, Anstrom KJ, Whellan DJ, Kitzman DW, Aurigemma GP, *et al*. Costs for heart failure with normal vs reduced ejection fraction. Archives of internal medicine. 2006 Jan; 166(1): 112-8. doi: 10.1001/archinte.166.1.112

[24] Fonarow GC, Stough WG, Abraham WT, Albert NM, Gheorghiade M, Greenberg BH, *et al*. Characteristics, treatments, and outcomes of patients with preserved systolic function hospitalized for heart failure: a report from the OPTIMIZE-HF Registry. Journal of the American College of Cardiology. 2007 Aug; 50(8): 768-77.doi: 10.1016/j.jacc.2007.04.064

[25] Mohammed SF, Borlaug BA, Roger VL, Mirzoyev SA, Rodeheffer RJ, Chirinos JA, *et al*. Comorbidity and ventricular and vascular structure and function in heart failure with preserved ejection fraction: a community-based study. Circulation: Heart Failure. 2012 Nov; 5(6): 710-9. doi: 10.1161/CIRCHEARTFAILURE.112.968594

[26] Tribouilloy C, Rusinaru D, Mahjoub H, Souliere V, Levy F, Peltier M, *et al*. Prognosis of heart failure with preserved ejection fraction: a 5 year prospective population-based study. European heart journal. 2008 Feb; 29(3): 339-47. doi: 10.1093/eurheartj/ehm554

[27] Hogg K, Swedberg K, McMurray J. Heart failure with preserved left ventricular systolic function: epidemiology, clinical characteristics, and prognosis. Journal of the American College of Cardiology. 2004 Feb; 43(3): 317-27. doi: 10.1016/j.jacc.2003.07.046.