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AN ATTEMPT TO DECIPHER THE AMBIGUITIES OF INCREASED SIX MONTHS HOSPITAL READMISSION IN HEART FAILURE PATIENTS

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ABSTRACT

Background: Heart failure (HF) has high in-hospital mortality and is associated with high readmission rates. Reasons for and ways to avoid HF readmissions are unclear. Approximately one-third of patients admitted for HF are readmitted within 6 months. We still desperately need to know some of the independent variables that would define high-risk groups of HF patients for re-hospitalization. **Methods and Results**: This is a prospective, observational study enrolled patients with ejection fraction (EF) <40%, were admitted because of acute decompensation. Out of the total 164 patients 63% were male. The mean age of the study population was 65.79 ±14.118. Male vs female, living at home independently and self -pay were statistically significant in the readmitted group (P=0.042, 0.007, 0.001). Co morbidity and clinical finding which showed significance increase with readmission include; hypertension(P=0.013), Acute coronary syndrome (P=0.015), mitral regurgitation (P=0.002), aortic regurgitation (P=0.014), LBBB (P=0.048), Urosepsis (P=0.008), and EF (P=0.041). Parameters on logistic regression analysis anemia (OR,1.7; CI,0.8-3.4), hypertension (OR,2.5; CI,1.2-5.4), ejection fraction less than 30% (OR, 1.9; CI, 0.9-3.7), mitral regurgitation (OR, 2.8; CI, 1.4-5.6), hyponatremia (OR,2.0. CI, 0.5-7.6), and high creatinine (OR, 1.3; CI,0.6-2.8) were independently increased the risk of rehospitalization at six months of discharge. **Conclusion:** Rehospitalization rate was 33%. Higher rates of readmission were noted in those with older male, hypertensive patients, low EF, mitral regurgitation, impaired kidney function, anemia, hyponatremia, living at home independently and infections.

KEYWORDS: Heart failure, Anemia, hospital readmission.

INTRODUCTION

Heart failure (HF) is a prevalent and morbid chronic illness. According to the European Society of Cardiology and the American Heart Association, HF affects approximately 15 million Europeans and over 5 million Americans.[1,2]

HF is not only taxing to the patient, but also to the healthcare system. Studies evaluating the economic burden of HF among several countries reveal estimated direct HF costs of 1%-2% of total healthcare expenditures, with approximately two-thirds of costs attributable to hospitalization.[3]

Heart failure (HF) remains a rising global epidemic with an estimated prevalence of >37.7 million individuals globally.[4,5]

According to annual report of Palestinian ministry of health 2013 the data related to CHF was 11.9% in west bank and 15.5% in age group 60 years and above (Health Annual Report, 2013), no data were available for Gaza.[6]

Heart failure (HF) is a complex clinical syndrome characterized by the reduced ability of the heart to pump and/or fill with blood,[7,8] From a physiological point of view, HF can be defined as an inadequate cardiac output to meet metabolic demands or adequate cardiac output secondary to compensatory neurohormonal activation (generally manifesting as increased left ventricular filling pressure).[8]

HF has recently been classified into three subtypes, namely HF with reduced ejection fraction (HFrEF), HF with preserved ejection fraction (HFpEF) and HF mid-range ejection fraction (HFmrEF), according to the ejection fraction, natriuretic peptide levels and the presence of structural heart disease and diastolic dysfunction.[9]

In Europe, 60% of the economic cost of HF is related to hospital admissions.[10] this is because HF is associated with high rates of recurrent hospitalizations and frequent clinic visits.

Data from developed countries show that one-half of HF patients are rehospitalized within 6 months of discharge.[11] and that 70% of these are due to worsening of previously diagnosed HF.[12]

METHODOLOGY

Study Design and Clinical Setting

This an observational prospective study for 164 patients who admitted (one or more admission) to cardiology department with diagnosis of Heart failure patients with the diagnosis of CHF who were hhospitalized in cardiology department AL Shifa central hospital in Gaza from first of May 2019-31.October 2019.

Cardiac readmission was defined as any subsequent admission for various causes that are related to the heart failure.

Inclusion criteria included patients with age >18 years, 2D Echocardiogram showing systolic dysfunction (left ventricle ejection fraction [LVEF] <40% as per European Society of Cardiology 2016 guidelines[13] within 6 months of admission, having at least one of the following findings on chest X-ray (CXR): pulmonary edema, pulmonary congestion, cardiomegaly, and/or pleural effusion and at least two of the following: dyspnea, peripheral edema, clinical signs of volume overload, jugular venous distention, left ventricle S3 gallop, heart rate >100 beats per minute.

Clinical Evaluation

Informed consent was obtained from the subjects and/or parents and the protocol was cleared by the Institutional Ethical Commit.

A standard case report form was used in data collection also clinical data were collected by face to face interview and from patient`s hospital files. Baseline clinical and demographic variables, such as age, sex, contact addresses, telephone numbers of patients and their relations, marital status, occupation, and history of cardiovascular risk factors, such as hypertension, Diabetes Mellites, family history, cigarette smoking, etc, were collected. Also collected were the signs and symptoms, clinical diagnoses, comorbidities, medications, result of investigation, date of discharge, and the date of next appointment to cariology out clinic.

Blood pressure was recorded according to a standard guideline,[13] Patients were weighed without shoes and in light clothing on a standard beam balance. Heart rate, NYHA classification (New York heart association) etiology of heart failure, presence of coronary artery disease (CAD), Atrial Fibrillation (AF), Stroke, Hypertension (HTN) which was defined as BP higher than 140/90 or taking antihypertensive medication, Diabetes Mellitus (DM) was determined by fasting blood sugar >126 mg/dl, HbA1c > 6.5 or taking anti diabetic medication.

History of documented CAD, valvular heart diseases, history of thyroid disease, surgical cardiac intervention, Cardiac Devices Implantations, Chronic Kidney Disease, and laboratory test (CBC, Sodium, potassium, creatinine, urea, uric acid and HbA1c level, urine analysis and Culture also were obtained.

The study variables also included:living dependently or independently, competence with physicians instruction, also we ask about the resources of medical treatment (health insurance system, self-pay, mixed, or has no resources) and if it is guideline directed medical treatment or not, length of stay in hospital and check the list of medication on discharge.

Time from discharge to visit cardiology out clinic also was considered in the study and was divided to five groups: within one week, within two weeks, within one month, one to 6 months and no visit within six months.

Anemia was defined by the World Health Organization as hemoglobin (Hb) < 12 g/dL in females and < 13 g/dL in males.

Chronic Kidney Disease (Renal dysfunction) was defined as eGFR of < 60 mL/min/1.73 m2 The diagnosis of heart failure was done by cardiologist based on clinical history, physical examination, chest radiography and transthoracic Echocardiography.

Twelve-lead electrocardiographic tracing (ECG) was obtained with the use of a cardioline electrocardiograph, and the reports were analyzed by the authors blinded to the clinical history of the patients. M-Mode, 2-dimensinal, and Doppler echocardiography were performed with the use of Philips HD7 XE Ultra Sound Machine.

Follow-Up

The patients were followed for a period of 6 months. Information on readmissions was assessed again face to face, by clinical examination and by proceeding Lab, CXR, ECG, Echo Doppler examination, also was assessed through hospital case record at the end of 6 months.

The patients were divided into 2 groups (group 1, those not rehospitalized (single admission); and group 2, those rehospitalized (one or more readmission). They were compared accordingly.

Continuous data are expressed as mean ± SD, Categorical variable were presented as counts and precents and were compared using by chi square test for statistical significance testing,

RESULTS

Table (1): Personal history.

Variable	All No (164)		No readmission N (110)		Readmission N (54)		p-value
Age (Mean)	65.79 ±14.118		65.8 ±14.46		65.78 ±13.52		0.992
Gender							
Male	86	52.4%	52	47.3%	34	63.0%	0.042
Female	78	47.6%	58	52.7%	20	37.0%	
Marital Status							
Married	154	93.9%	102	92.7%	52	96.3%	0.301
Single	10	6.1%	8	7.3%	2	3.7%	
Living at home independently							
Yes	108	65.9%	80	72.7%	28	51.9%	0.007
No	56	34.1%	30	27.3%	26	48.1%	
The source of medications							
Health insurance	56	34.1%	46	41.8%	10	18.5%	0.001
Self-pay	48	29.3%	26	23.6%	22	40.7%	
Mixed	56	34.1%	38	34.5%	18	33.3%	
Didn't use medications	4	2.4%	0	0.0%	4	7.4%	
Smoking							
No	116	71.6%	80	72.7%	36	69.2%	0.308
Yes	18	11.1%	14	12.7%	4	7.7%	
X smoker	28	17.3%	16	14.5%	12	23.1%	

One hundred sixty-four patients, comprising 86 men (52.4%) and 78 (47.6%) women, who were admitted with Heart Failure and followed for 6 months as shown in table (1), The readmitted group were significantly more for men 63.0% vs. women 37.0%; P value =0.042. The main age study population was 65.79 ±14.118 years and 65.78 ±13.52 in readmitted group and there was no difference between two group P-value 0.992. Similarly, no significant difference has been observed between two groups regarding their marital status and smoking.

However a significant difference was observed between the two groups in participants who living at home independently 65.9% in all sample and 51.9% in readmitted patients; P value =0.007, and a significant difference regarding the source of medication; in the readmitted patient who had health insurance, self-pay, mixed or did not use the medications 18.5%, 40.7%, 33.3%, 7.4% respectively with P value =0.001.

Table (2): Co morbidities history.

Variable	All No (164)		No readmission N (110)		Readmission N (54)		p-value
Chronic Kidney Disease							
Yes	66	40.2%	46	41.8%	20	37.0%	0.339
No	98	59.8%	64	58.2%	34	63.0%	
Hypertension							
Yes	128	78.0%	92	83.6%	36	66.7%	0.013
No	36	22.0%	18	16.4%	18	33.3%	
Diabetes Mellitus							
Yes	106	64.6%	76	69.1%	30	55.6%	0.64
No	58	35.4%	34	30.9%	24	44.4%	
Permanent Atrial Fibrillation							
Yes	66	40.2%	46	41.8%	20	37.0%	0.339
No	98	59.8%	64	58.2%	34	63.0%	
Documented CAD							
Yes	80	48.8%	50	45.4%	30	55.6%	0.147
No	84	51.2%	60	54.5%	24	44.4%	
Device Type							
No Device	142	86.6%	104	94.5%	38	70.4%	0.000
PPM	2	1.2%	0	0.0%	2	3.7%	
ICD	8	4.9%	0	0.0%	8	14.8%	
CRT	12	7.3%	6	5.5%	6	11.1%	

Old CVA							
Yes	24	15.4%	16	15.1%	8	16.0%	0.528
No	132	84.6%	90	84.9%	42	84.0%	
Thyroid disease							
Yes	22	13.4%	14	12.7%	8	14.8%	0.442
No	142	86.6%	96	87.3%	46	85.2%	
Chronic Obstructed pulmonary disease (COPD)							
Yes	22	13.9%	14	13.2%	8	15.4%	0.442
No	136	86.1	92	86.8%	44	84.6%	

CAD = Coronary Artery Disease; CRT = Cardiac Synchronization Therapy; CVA = Cerebrovascular Accident; ICD = Intracardiac Defibrilator; PPM = Permanent Pace Maker.

The co-morbidities are listed in table 2, among 78.0% of patients with CHF had hypertension with 66.7% in the readmitted groups, value for significance was 0.013. The other most common morbidities were diabetes and chronic kidney diseases which were present in 62.7%, 59% of all patients respectively. 40.2% had a history of permanent atrial fibrillation, 48.8% with documented CAD, only 15.4% had old CVA, and 13.4%, 13.9% of all patient had hypothyroidism and Chronic Obstructed pulmonary disease (COPD) respectively; for all these variables the difference between two groups doesn`t reach a statistical significance level.

we noted in our study that presence of devices like, ICD and CRTD were 12.3% from all population had a statistically significance in the readmission(P=0.00).

Table (3): Clinical Presentation on admission.

Variable	All N (164)		No readmission N (110)		Readmission N (54)		P-value
Pneumonia							
Yes	16	9.8%	8	7.3%	8	14.8%	0.108
No	148	90.2%	102	92.7%	46	85.2%	
URTI							
Yes	16	9.8%	14	12.7%	2	3.7%	0.054
No	148	90.2%	96	87.3%	52	96.3%	
UTI/Urosepsis							
Yes	20	12.2%	8	7.3%	12	22.2%	0.008
No	144	87.8%	102	92.7%	42	77.8%	
Acute Coronary Syndrome (ACS)							
STEMI	4	2.5%	4	3.6%	0	0.0%	0.015
NSTEMI	4	2.5%	0	0.0%	4	7.7%	
UAP	12	7.4%	8	7.3%	4	7.7%	
No ACS	142	87.7%	98	89.0%	44	84.6%	
Cardiogenic Shock							
Yes	20	12.2&	16	14.5%	4	7.4%	0.144
No	144	87.8%	94	85.5%	50	92.6%	
Acute Pulmonary edema							
Yes	92	56.1%	62	56.4%	30	55.6%	0.527
No	72	43.9%	48	43.6%	24	44.4%	
Exacerbation of heart failure							
Yes	156	95.1%	104	94.5%	52	96.3%	0.476
No	8	4.9%	6	5.5%	2	3.7%	
Moderate to severe mitral regurgitation							
Yes	58	35.4%	30	27.3%	28	51.9%	0.002
No	106	64.6%	80	72.7%	26	48.1%	
Moderate to severe aortic Valve regurgitation							
Yes	12	7.3%	4	3.6%	8	14.8%	0.014
No	152	92.7%	106	96.4%	46	85.2%	
Moderate to severe tricuspid Valve regurgitation							
Yes	36	22.0%	22	20.0%	14	25.9%	0.252
No	128	78.0%	88	80.0%	40	74.1%	

NSTEMI = Non ST Elevation Myocardial Infarction; STEMI = ST Elevation Myocardial Infarction; URTI = Upper Respiratory Tract Infection; UTI = Urine Tract Infection

As shown in table (3) 35.4% of heart failure patients had moderate to severe mitral regurgitation, 51.9% of them significantly had readmission(p=0.002). 7.3% of heart failure patients had moderate to severe aortic Valve regurgitation, and 14.8% of patients with aortic valve disease were readmitted and had statistically significance (p=0.014).

7.4% of population sample on presentation had unstable angina pectoris, 2.5% had NSTEMI and 2.5% had STEMI; the value of significance between two groups was 0.015.

56.1% were admitted with acute pulmonary edema with no significance differences between the two groups.

12.2% of patients were admitted with cardiogenic shock, 95.1% were admitted due to exacerbation of heart failure.

9.8% of the patients had pneumonia on admission. 3.7%, 22.2% of the readmission groups had URTI and Urosepsis respectively and had statistically significance (P=0.054, P=0.008).

Table (4): ECG and Echo finding.

Variable	All N (164)		No readmission N (54)		Readmission (110)		P-Value
LBBB							
Yes	24	14.6%	12	10.9%	12	22.2%	0.048
No	140	85.4%	98	89.1%	42	77.8%	
RBBB							
Yes	18	11.0%	8	7.3%	10	18.5%	0.31
No	146	89.0%	102	92.7%	44	81.5%	
Sinus Rhythm							
Yes	98	59.8%	64	58.2%	34	63.0%	0.339
No	66	40.2%	46	41.8%	20	37.0%	
Ejection Fraction							
Severe	62	37.8%	36	32.7%	26	48.1%	0.041
Moderate	102	62.2%	74	67.3%	28	51.9%	

RBBB = Right Bundle Branch Block; LBBB = Left Bundle Branch Block.

ECG and Echocardiography finding are shown in table (4), 59.8% of study population were in sinus rhythm and 63.0% of the readmitted group were in sinus rhythm with no statistically significance. LBBB was found in 22.2% in the readmission group and 10.9% in the non-readmitted groups, the value of significance p=0.048. In contrast RBBB was present in 11.0% of total population, but with no significance variation in the two groups of readmission and non-readmission. The total population had either severe low ejection fraction 37.8% or moderate low ejection fraction 62.2% and the variation between the readmission and non-readmission was statistically significant; P=0.041.

Table (5): Lab investigations and vital signs.

Variable (Mean)	No ReadmissionN (110)	ReadmissionN (54)	P-Value
GFR	49.82 ±24.819	51.77 ±22.321	0.626
Creatinine	1.65 ± 1.077	1.5 ± 0.521	0.418
Urea	73.49 ±39.147	83.96 ±44.379	0.126
Na	138.76 ± 5.683	135.59 ± 9.244	0.008
Uric acid	7.17 ± 1.585	7.93 ± 1.888	0.008
K+	4.51 ± 0.672	4.31 ± 0.765	0.095
Ca++	8.67 ± 1.345	8.87 ± 0.613	0.888
Hb	10.91 ±2.060	11.25 ±2.320	0.338
HbA1c	7.14 ± 1.631	6.34 ± 1.441	0.003
RBS	193.25 ± 92.735	162.85 ± 76.185	0.038
Ejection fraction	31.69 ± 6.978	27.81 ± 8.843	0.003
Systolic BP	123.13 ± 37.312	117.52 ± 27.838	0.329
Diastolic BP	69.78 ± 21.315	` 73.59 ± 12878	0.228

Values are expressed as mean ± Standard deviation. Ca = Calcium; GFR = Glomular Filtration rate; Hb = Hemoglobin; HBA1c = Hemoglobin A1c (glycated haemoglobin); K= Serum potassium; Na = serum sodium; RBS = Random Blood Sugar.

We found in table (5) that the mean left ventricular Ejection fractions LVEF (±SD) was 31.69 ±6.978, chi-square test was statically significant p< 0.003. The independent t-test difference was significant with the mean level of uric acid, Sodium, RBS, and hemoglobin A1c.

Table 6: Risk factors associated Heart Failure.

Variable	P-Value	B	Odds Ratio	95% Confidence Interval	
				Lower	Upper
Hypertension	0.015	0.938	2.556	1,197	5.456
Ejection Fraction <30	0.057	0.646	1.909	0.981	3.715
Moderate to severe mitral regurgitation	0.002	1.055	2.872	1.456	5.663

LOGISTIC REGRESSION ANALYSIS IN PREDICTING REHOSPITALIZATION

The variables proved to have statistical significance association with occurrence of readmission are included as independent variable in the logistic regression model demonstrate in table (6) which showed that anemia, high creatinine and urea level, hyponatremia, Hyponatremia, low ejection fraction(below 30%) and patients with mitral valve disease are the major independent risk factors for readmission.

DISCUSSION

In this prospective study, we analyzed rehospitalization rate and predictors of rehospitalization in patients with LVEF <40% who were admitted for acute decompensation.

Hospital readmissions remain a continued challenge in the care of the heart failure patient. Although small gains have been made over the past 5 years, still more than 20% of patients are readmitted within 30 days and up to 50% by 6 months.[15] In our study the readmission rates were 33 % during the 6 months.

A. Hoang-Kim et al., conducted a scoping review to include full text articles published between 2002 and 2017; they demonstrated that twelve of 34 studies reported higher heart failure readmission rates for men and six studies reported higher heart failure readmission rates for women.[16]

In our study the readmitted group were significantly more for men 63.0% vs women 37.0%; P-value =0.042.

Functional status/Activities of daily living (ADL), frailty, mobility and disability, are associated with readmissions. Anderson found that individuals with HF who require assistance with ADLs were significantly more likely to be readmitted for heart failure within 60 days,[17] similarly we found that re-admission rate increased in patient with impaired ADLs (Living at home independently)

Since most of heart failure patients associated with multiple other comorbidities that place additional medical, logistic, and financial burdens on patients and regardless of causal heart failure readmission in the relationship between the different type of patient's source of medications with readmission rates, the fact of the observed association with self-paying the medication completely or partially is of great cause of readmission rates. In our study it was significantly that the readmission rate increased in self-paying group of patients.

According to Ahmed Tawakol et al, there are also biologically driven neurologic-cardiac-inflammatory pathways that physiologically mediate some of the link between socioeconomic stress and worse cardiovascular disease including heart failure.[18]

therefore, socioeconomic patient factors are crucial components of the HF readmission conundrum.

Also, it was demonstrated in our study that patients not attending the follow up appointment in regular intervals has increase rate of readmission. Post discharge outpatient follow-up appointments after a hospitalization for heart failure represent a potentially effective strategy to prevent heart failure readmissions.

It has frequently been incorporated into transitional care model interventions aimed at improving post discharge outcomes, such as readmission and mortality, and is supported by the American Heart Association and American College of Cardiology.[19]

Hypertensive heart disease was the most common (78%) cause of heart failure with 66.7% in the readmitted groups. This is not unusual as hypertension is the most prevalent cardiovascular disease in our population, similar data was reported by Ojji et al.[20]

Readmissions among heart failure patients after a recent hospital discharge are influenced by multiple potential factors and identifying those at high risk of hospital readmission has been a challenging subject. To be consistent with previously published studies of HF rehospitalization,[21] we found infection as the most common cause of precipitation of HF on index admission. More than 12 % of all admitted patient with heart failure had UTI with increased ratio of readmission p value = 0.008. Similar data of UTI as comorbidity of heart failure admission was reported by Ogbemudia & Asekhame. 2016 ((Ogbemudia EJ, Asekhame J. Rehospitalization for heart failure in the elderly.

10% of all admitted patients with heart failure had URTI with increased ratio of readmission p value = 0.054. Similar data reported by Ogbemudia & Asekhame in 2016.

Goyal et al, demonstrated that only half of the patients discharged home following a hospitalization for heart failure had a follow-up appointment scheduled, representing a missed opportunity to provide a recommended care transition intervention.[22]

In India in 2020, S.S.L. Akkineni, et al. showed in his study that the anemia was the most common co-morbidity followed by diabetes mellitus and hypertension among HF patients with readmissions.[23]

In North-Eastern Tanzania in 2020 Abid M. Sadiq demonstrated that Readmission was strongly associated with unemployment, absence of ACEI or ARBs, poor medication adherence, and pleural effusion.[24]

We found that simple laboratory test such as hemoglobin and sodium level might act as a predictor for rehospitalization in heart failure.

Anemia is highly prevalent in heart failure (HF) patients. Its prevalence among patients with HF estimates can range from 30% to 70% in some studies depending on the cutoff value used to define its presence and, on the population, considered.[25]

Lower hemoglobin level at admission is likely related to hemodilution secondary to volume overload, malabsorption due to bowel congestion and the high number of associated chronic diseases.

There are several proposed mechanisms by which anemia may worsen HF outcomes, including LV remodeling, increased inflammatory cytokines, activation of neurohumoral systems, and adverse cardiorenal effects.[26]

In our study we demonstrated 70.7% of patients at higher risk for readmission odds ratio 1.723 S.S.L. Akkineni, et al has demonstrated similar effect.[27]

Hyponatremia is a common electrolyte disturbance encountered in 15–25% of patients with AHF before and during decongestion and has been associated with impaired diuretic response and adverse events[28] and in our study it is associated with higher rate of readmission odds ratio 2.045, similar finding was seen by Ogah et, al.[29]

40.2% of the all admitted patient with heart failure had CKD, and we demonstrated that elevated creatinine and urea increasing the risk of readmission and odds ratio was 1.357 and 2.371 respectively Kakasaheb et, al. demonstrated in 2020 similar findings.[30]

One explanation for worse outcomes in CKD could be lack of effective therapeutic options available or possible underutilization of current therapies due to apprehensions surrounding side effects. Moreover, various factors like volume and pressure overload, anemia and uremic toxins may be contributing to disease process in these patients.

We only enrolled patients with LVEF <40%. Similar to previous studies, patients with higher EF in our study had lesser risk of rehospitalization at six months of discharge.

Our finding of higher risk of readmission in patients with poor left ventricular function EF <30%, odds ratio 1.909 is similar to the findings of Babayan et, al.[31]

This suggests that patients with very low EF (<30%) should be optimized with better pharmacological treatment, frequent follow-up visits with tailored changes and measures to improve EF like the use of CRT.

Presence of moderate to severe mitral regurgitation increased the risk of readmission odds ratio 2.872 Similar to the finding of K. H. Bhosale et, al.[32]

Study Limitations

research is often problematic and challenging in a resource-poor environment. Our study sample size was relatively small. It was an observational study and thus prone to observer bias. These results could not be generalized to the whole spectrum of HF patients because of potential selection bias. All predictors were not included in the study, so further evaluation with larger study is warranted.

CONCLUSION

Ppatients with HFrEF continue to have significantly higher rehospitalization rate. HFrEF rehospitalization within 6 months follow-up occurred in 33% of patients in our cohort. Predictors of worse outcomes after an initial HF hospitalization which increased the rates of readmission were noted in elderly men, living at home independently, medication self-paying group of patients, hypertension, low ejection fraction, mitral regurgitation, URTI, UTI, hyponatremia, hyperuricemia and elevated HbA1c. These predictors can be used to identify patients who require aggressive tailored therapy and follow-up.

It is suggested that all patients hospitalized for HF should be risk-stratified as high or low risk of rehospitalization according to the presence of the number of predictors. Those patients who are at the highest risk for rehospitalization should be given the highest intensity of multi-disciplinary support, education, follow-up, therapy, and access to resources, while those at lower risk should be followed less frequently in HF clinics. This approach with instructed programs is crucial when resources are sparse and finances limited and may lead to reduced readmission of HF patients.

Further research is needed to identify the targets to reduce the rehospitalization rate and to improve survival among patients with HFrEF.

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