

Frequency of readmission in Iranian heart failure patients within six months after discharge and its association with guideline directed medical treatment

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ABSTRACT

Background and Aims: Assessment of heart failure (HF) therapy based on guideline was less frequently performed. **Objectives:** In this study, we aimed to evaluate the frequency of readmission or mortality in HF patients according to guideline directed medical treatment. **Materials and Methods:** This retrospective cohort study was done from March 2016 to March 2017 in one of the tertiary heart centers located in Isfahan, named Chamran Hospital. A total of 503 patients with a diagnosis of HF were recruited in the research. Demographic data, prescribed medication, and para-clinic information were gathered during hospitalization period. The frequency of re-hospitalization and mortality was assessed 6 months after discharge, and its relation with aforementioned variables was evaluated. **Results:** The mean age of participants with the dominance of males (61.8%) was 70.8 ± 11.8 years. A total of 175 (34.8%) patients had been readmitted or died during 6-month follow-up. Participants with New York Heart Association (NYHA) functional class of IV and renal diseases had raised likelihood of re-hospitalization or death (odds ratio [OR]: 5.59, 95% confidence interval [CI] = 1.42–21.5, $P = 0.001$ and OR: 2.53, 95% CI = 1.11–5.79, $P = 0.02$, respectively). In contrast, individuals with heart rates (HR) of 80–100 beats/min showed decreased chance of adverse clinical outcomes compared to subjects with HRs of <60 beats/min (OR: 0.08, 95% CI = 0.009–0.77, $P = 0.02$). **Conclusion:** Our data suggested that HF patients having higher NYHA functional class or kidney problems and HRs of 80–100 beats/min had increased and decreased likelihood of readmission and mortality, respectively. Several longitudinal studies are required confirming these associations.

KEY WORDS: Diabetes mellitus, Heart failure, Hypertension, Patient admission

INTRODUCTION

Heart failure (HF) is a clinical syndrome due to structural and functional heart problems leading to the inability of proper filling and ejection. The main clinical symptoms include dyspnea, lower limbs edema, and

extreme fatigue, which consequently decline patients' quality of life.^[1] Exercise or occasionally lying down has been proved to worsen dyspnea. The most common etiologic factors contributing to HF include coronary artery diseases, history of myocardial infarction (MI), atrial fibrillation, valvular heart diseases, heavy alcohol consumption, and cardiomyopathies.^[2] Although decreasing mortality rate because of cardiovascular diseases (CVDs) is promising, raising readmission rate is worrisome.^[3–5] CVDs plus neoplasms pose the

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main percentages of re-hospitalization in comparison with other diseases.^[6-8] Aranda *et al.*'s study reported that readmission percentage due to HF was estimated to be 60%.^[9] Furthermore, hospital readmission especially in older individuals has been associated with greater mortality rates and declining the feeling of well-being.^[2,10] With respect to this point that major causes of re-hospitalization would be preventable, several prospective studies showed that 12–75% of readmission rates could be prevented by simple tasks, including educational programs and proper home-based care.^[2,11,12] Till now, there is no general consensus about possible effective preventable parameters in readmission rates among nations.^[2] To enhance CVDs management and implementing proper strategies which are ultimately results in increasing patients' quality of life, recognition of aforementioned factors are seemed to be necessary.^[11,13,14] It has been reported that more than 20 million persons suffer from HF worldwide and 0.2% of population will be affected by this disorder each year.^[9]

Because of controversial results in terms of HF re-hospitalization according to previously proved guideline therapeutic strategies, in this article, we aimed to assess the frequency of 6-month post HF readmission rate and its relation with guideline directed medical treatment consisting consumption manner of beta-blockers, furosemide as a diuretic and angiotensin-converting enzyme inhibitors (ACEI) or angiotensin receptor blockers (ARB) in Iranian patients.

MATERIALS AND METHODS

This retrospective cohort study was done in one of the most popular tertiary heart center located in Isfahan, named Chamran hospital. From March 2016 to March 2017, any individuals admitted for HF willing to participate in the project were selected. Age of <18 years was considered as an exclusion criteria. HF registry checklist was utilized for data gathering by the investigator. This questionnaire contained four main items including as the followings: Item one (body mass index, heart rate(HR), blood pressure (BP), and primary HF etiology), item two (clinical history in addition to smoking status, alcohol consumption, physical activity status, presence/absence of AF, diabetes mellitus or thyroid diseases plus history of CVDs or chronic disorders, and usages of instruments to improve cardiac function), item three (data of physical examination, laboratory, and drug prescription during admission), and item four (thorough drug history including ACEIs, ARBs, beta-blockers, and oral diuretics before and during hospitalization and after discharge). 6 months after HF occurrence, follow-up form was utilized collecting information including the number of readmission due to HF plus mortality rate through telephone interview.

After merging information, data of 503 individuals were available for analysis. Categorical and continuous variables were reported as frequency (percentage) and mean $\pm$ standard deviation, respectively. Chi-square test was used analyzing nominal variables. The logistic regression model was used assessing relation of desired variables with readmission and mortality. All analyses were done using (Statistical Package for the Social Sciences Inc., version 20.0, Chicago, IL, USA) and $P < 0.05$ was considered statistically significant.

RESULTS

The mean age of participants was 70.8 ± 11.8 years. Male participants were the dominant group (61.8%). General characteristics and demographic data of the study population are provided in Table 1. Our data suggested that 34.8% of individuals were readmitted or died within 6 months after HF attack. More than half of patients had been prescribed diuretics and beta-blockers at the time of discharge. Furthermore, the most common initial medical history found in participants were ischemic heart disease (82.3%) and hypertension (66.8%). More than 50% of subjects at the time of admission were belonged to New York Heart Association (NYHA) IV functional class category based on their symptoms.

Table 1: General characteristics and demographic data of study population¹ (n=503)

Variables	Mean $\pm$ SD
Age (years)	70.8 $\pm$ 11.8
Gender) male) (%)	311 (61.8)
Positive smoking (%)	264 (52.5)
Systolic blood pressure (mmHg)	117.4 $\pm$ 21.85
Heart rate (beats/min)	78.5 $\pm$ 9.7
Hemoglobin (g/dl)	13.3 $\pm$ 5.12
Creatinine (μ mol/L)	0.8 $\pm$ 1.16
Medications	
ACEI (%)	93 (18.5)
ARB (%)	238 (47.3)
Loop diuretics (%)	316 (62.8)
Beta-blockers (%)	262 (52.1)
Aldosterone antagonists (%)	190 (37.8)
Medical history	
Ischemic heart disease (%)	414 (82.3)
Hypertension (%)	336 (66.8)
Diabetes mellitus (%)	239 (47.5)
Myocardial infarction (%)	145 (28.8)
Arrhythmia (%)	88 (17.5)
COPD (%)	58 (11.5)
Anemia (%)	44 (8.7)
CKD (%)	121 (24.1)
Cancer (%)	12 (2.4)
Stroke (%)	21 (4.2)
Functional class	
NYHA(III)	48 (9.5)
NYHA ^[2]	267 (53.1)
Readmission & death	
Positive	175 (34.8)
Negative	328 (65.2)

¹All values are mean $\pm$ SD unless indicated. ACEI: Angiotensin-converting enzyme inhibitor, ARB: Angiotensin receptor blocker, COPD: Chronic obstructive pulmonary disease, CKD: Chronic kidney disease, NYHA: New York Heart Association, SD: Standard deviation

Table 2 showed demographic and hemodynamic information of participants according to readmission or death status. Patients who died or had been re-hospitalized were mostly men, but functional class deterioration was found less frequently. There was no significant relation in terms of medical history, BP, HR or prescribed drugs at discharge time.

Odds ratio (OR) of readmission or death based on pre-defined measured variables is announced in Table 3. Our outcomes revealed that patients with renal problems had 2.53 (95% confidence interval (CI) = 1.11–5.79, $P = 0.02$) times more likelihood of death or being re-hospitalized compared to individuals with normal kidney functions. Moreover, participants with functional class of IV showed increased risks of adverse

outcomes after discharge compared to reference group (OR: 5.59, 95% CI = 1.42–21.5, $P = 0.01$).

In contrast, individuals with their HRs ranged 80–100 beats/min had 92% (OR: 0.08, 95% CI = 0.009–0.77, $P = 0.02$) of decreased likelihood of re-hospitalization or death in comparison to persons with HRs of <60 beats/min. No significant relation was found based

Table 2: Demographic and hemodynamic information of participants according to readmission or death status¹ (n=503)

Characteristics	Readmission and death	
	Negative	Positive
Age (years)	70.4±11.9	71.5±11.6
Age specified group (%)		
<65	108 (32.9)	52 (29.9)
65–85	177 (54)	98 (56.3)
>85	43 (13.1)	24 (13.8)
Gender (male) (%)	195 (59.5)*	116 (66.3)
Positive smoking (%)	171 (69.2)	93 (72.1)
Systolic blood pressure (mmHg)	119.5±21.7	113.3±21.5
Systolic blood pressure specified group (%)		
≥100 mmHg	64 (20.3)	51 (30.2)
<100 mmHg	251 (79.7)	118 (69.8)
Heart rate (beats/min)	78.5±9.2	78.4±10.6
Heart rate specified group (%)		
<60 (beats/min)	12 (3.9)	6 (3.7)
60–80 (beats/min)	197 (63.3)	106 (64.6)
80–100 (beats/min)	98 (31.5)	48 (29.3)
>100 (beats/min)	4 (1.3)	4 (2.4)
Hemoglobin (g/dl)	12.42±4.8	11.10±5.5
Creatinine (μmol/L)	0.7±1.1	0.9±1.2
Medications		
ACEI (%)	51 (17)	42 (25.9)
ARB (%)	165 (55)	73 (45.1)
Diuretics (%)	199 (66.3)	117 (72.2)
Beta-blockers (%)	180 (60)	82 (50.6)
Aldosterone antagonists (%)	119 (39.7)	71 (43.8)
Past medical history		
Ischemic heart disease (%)	267 (82.7)	147 (85)
Hypertension (%)	222 (67.9)	114 (65.9)
Diabetes mellitus (%)	150 (45.7)	89 (50.9)
Myocardial infarction (%)	81 (25.1)	64 (36.8)
Arrhythmia (%)	61 (18.6)	27 (15.5)
COPD (%)	39 (11.9)	19 (10.9)
Anemia (%)	22 (6.7)	22 (12.6)
CKD (%)	68 (20.9)	53 (30.5)
Cancer (%)	8 (2.5)	4 (2.3)
Stroke (%)	10 (3)	11 (6.3)
Functional class		
NYHA (III)	39 (18.8)	9 (8.4)
NYHA ^[2]	169 (81.3)*	98 (91.6)

¹All values are mean±SD unless indicated. *: Indicated $P < 0.05$.

ACEI: Angiotensin-converting enzyme inhibitor, ARB: Angiotensin receptor blocker, COPD: Chronic obstructive pulmonary disease, CKD: Chronic kidney disease, NYHA: New York Heart Association

Table 3: OR of readmission or death according to different measured variables (n=503)

Readmission and death	OR (95% confidence interval)	P-value
Age		
<65	1.00	
65–85	1.468 (0.63–3.38)	0.36
>85	3.147 (0.98–10.02)	0.05
ACEI		
Negative	0.60 (0.24–1.49)	0.27
Positive	1.00	
ARB		
Negative	1.60 (0.72–3.56)	0.24
Positive	1.00	
Diuretics		
Negative	0.99 (0.40–1.15)	0.99
Positive	1.00	
Beta-blockers		
Negative	0.94 (0.90–2.1)	0.89
Positive	1.00	
Aldosterone antagonists		
Negative	0.67 (0.31–1.43)	0.30
Positive	1.00	
Heart rate		
<60	1.00	
60–80	0.124 (0.01–1.09)	0.60
80–100	0.084 (0.009–0.773)	0.02
>100	-	-
Systolic blood pressure		
<100	0.50 (0.22–1.13)	0.09
≥100	1.00	
Myocardial infarction		
Positive	2.20 (0.98–4.90)	0.05
Negative	1.00	
Anemia		
Positive	1.65 (0.53–5.18)	0.38
Negative	1.00	
NYHA functional class		
III	1.00	0.01
IV	5.59 (1.45–21.58)	
Smoking status		
Positive	2.22 (0.94–5.23)	0.06
Negative	1.00	
Thyroid diseases		
Positive	1.99 (0.58–6.75)	0.26
Negative	1.00	
COPD status		
Positive	1.14 (0.39–3.30)	0.80
Negative	1.00	
History of arrhythmia		
Positive	0.94 (0.38–2.31)	0.90
Negative	1.00	
Renal problems		
Positive	2.53 (1.11–5.79)	0.02
Negative	1.00	
Diabetes mellitus		
Positive	0.90 (0.42–1.93)	0.79
Negative	1.00	

ACEI: Angiotensin-converting enzyme inhibitor, ARB: Angiotensin receptor blocker, COPD: Chronic obstructive pulmonary disease, OR: Odds ratio

on other variables, including medication usages, MI, HTN, smoking status, thyroid diseases, presence/absence of arrhythmia, DM or any age-specific group.

DISCUSSION

The aim of this current study was evaluating the frequency of 6-month readmission and its relation with proved guideline therapeutic strategies in patients suffering from HF. The purpose of guideline therapy was assessing the usages of three main medications commonly used in HF therapy, including beta-blockers, diuretics, and ACEIs or ARBs. We found that 34.8% of admitted HF patients died or had been re-hospitalized within 6 months after the occurrence of the disease which was lower than other studies. For instance, Aranda *et al.*'s study final frequency report was estimated to be 60%.^[9] It seems that appropriate management of this kind of patient might be responsible for declining the rate of readmission. Our data suggested that renal problems and higher NYHA functional class dysfunction were associated with increased risks of readmission or death (OR: 2.53, 95% CI = 1.11–5.79 and OR: 5.59, 95% CI = 1.42–21.5, respectively). In contrast, having HRs of 80–100 beats/min was associated with decreased likelihood of adverse post-discharge outcomes. Since hospitalization in HF patients has been associated with higher management costs and reducing individuals' quality of life, proper diagnosis and treatment of possible contributing factors might play an important role in this regard. In terms of renal disorders, Fu *et al.* enrolled 327 Chinese individuals suffering from HF with mean age of 85 years to investigate all-cause mortality during a median follow-up duration of 345 days. Their final analysis revealed that participants with concurrent chronic kidney diseases defined as glomerular filtration rate of <60 ml/min per 1.73 m² showed increased chances of mortality compared to subjects without desired problem (HR: 1.70, 95% CI = 1.13–2.56, $P = 0.01$). Furthermore, class IV NYHA in HF was reported to raise 1.19 times the chances of all-cause death (HR: 1.91, 95% CI = 1.28–2.85). By the way, their findings according to HR were disagreement with ours and showed a borderline increasing likelihood (HR: 1.02, 95% CI = 1.009–1.033).^[15] In another study data of 46217 HF individuals were retrospectively assessed to evaluate the relationship between discharge HR and mortality or re-hospitalization. They found that regular HR of <75 beats per minute was associated with 1.19 times increased chance of death within the first 30 days of follow-up, but not afterward (HR: 1.19, 95% CI = 1.07–1.32, $P = 0.0008$). However, individuals with sinus rhythm and HR ≥ 75 beats per minute had 1.30 and 1.15 times increased risk of mortality in the first 30 days and the next 31–365 ones of retrospective follow-up (HR: 1.30, 95% CI = 1.21–1.38, $P < 0.0001$

and HR: 1.15, 95% CI = 1.11–1.19, $P < 0.0001$, respectively). In terms of all-cause readmission, only the first defined follow-up assessment showed raised risk (HR: 1.12, 95% CI = 1.08–1.16, $P < 0.0001$).^[16] Although increasing age was related to raised probability of re-hospitalization or mortality; this relation was insignificant. However, gender analysis revealed that male patients were readmitted more frequently than females. Several studies have demonstrated that demographic factors including age, gender, education level, and chronic diseases have relations with readmission rate. For example, multiple studies revealed a significant relation in terms of age and re-hospitalization.^[9] Aranda *et al.* analyzed data of 28919 patients for investigating probable contributing factors responsible for re-hospitalization. Final results after 6–9 months follow-up duration in terms of age showed that individuals aged <65 years had increased likelihood of readmission.^[9] Although Chan *et al.* showed a relation in this regard, they defined readmission within 28 days after discharge, which might be effective in their outcomes.^[17] In terms of gender, multiple studies suggested controversial results ranged from no relation to one sex dominant one.^[9,18,19] Our data showed insignificant relation in terms of BP and readmission. Despite two studies showed the inverse association, Schwarz and Elman. Plus Hamner and Ellison results were in agreement with our outcomes.^[9,18,20] Smokers in this study had 2.2 times more likelihood of being re-hospitalized after prior discharge, but this relation has been found to be insignificant in a way that Steuer *et al.* did not prove any considerable relation in their final model.^[21] It seems that cigarette smoking could not be the sole possible effective mechanism by itself.

Quite adequate sample size as well as reasonable pre-defined follow-up duration to investigate the rate of mortality or readmission was some strengths of our study. However, current study was not free from limitations. We were unable to evaluate precise consumption of medications after prior discharge. Furthermore, usages of other drugs for chronic diseases might have been effective in our reportable results. Method of follow-up data gathering might be considered as a possible contributing factor making generalization of our findings with caution.

In conclusion, our findings suggested that among admitted HF patients increased NYHA functional class or having renal disorders had been associated with an increased chance of re-hospitalization or mortality in contrast to raised HR. Several prospective population-based studies required proving these relations.

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