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Readmission rates and related factors in heart failure patients: A study in Lebanon☆

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Summary
Background: Heart failure is the leading cause of hospitalization among older adults in the United States and other developed countries. Readmission rates of heart failure patients is one of the key outcome performance measures used in evaluating the quality of care of these patients. In Lebanon, there are no published data on readmission of heart failure patients. The aim of the study was to examine the readmission rates of heart failure patients within 30, 60 and 90 days of discharge from the hospital, and factors associated with readmission.
Methods: The medical records of all 187 patients admitted with heart failure to Rafic Hariri University Hospital in Beirut between January 1, 2010 and December 31, 2010 were reviewed. Data on demographic and relevant clinical variables were retrieved.
Results: Readmission rates were 15%, 22.2%, and 27.8% at 30, 60 and 90 days following discharge, respectively. The majority of readmissions (73.61%) were due to heart failure exacerbations. Significant predictors of readmission were: history of diabetes mellitus, coronary artery disease, length of stay at the index admission and gamma glutamyl transpeptidase levels. Management of the patients did not always conform to the evidence based guidelines.
Conclusion: The findings suggest the need for better adherence to clinical guidelines in caring for heart failure patients and improved documentation of discharge instructions.
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Introduction

Heart failure is a complex, chronic condition that affects millions of people every year. Diagnosis of new cases has tripled annually in the United States (US), Australia, and most countries of the world (Riegel et al., 2010). This pace of rising incidence is parallel with the rise in the aging population around the world (Riegel et al., 2010). The extensive

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cost of hospital management of this health condition has been well documented in the United Kingdom (Tansey, 2009), Australia (Krum et al., 2006), and the US (Russo et al., 2008). The estimated cost of treating heart failure patients was $32 billion dollars in 2013 in the US (Go et al., 2013). Heart failure requires continuous care and follow-up; failure to do so causes hospital readmissions and increased financial burden on patients and governments.

Heart failure is the number one cause of hospital admissions in the US in those older than 65 years of age (Roger et al., 2004). Moreover, readmission rates are higher in the heart failure population (24.5—27.9% within 30 days of discharge) when compared to other patient groups such as myocardial infarction (18.2—24.8%) or pneumonia (18.2—23.7%), as noted in two studies of Medicare patients in the US (Joynt, Orav & Jha 2011; Schneider, 2009). This fact makes it the number one cause of hospital readmissions as well (Jencks, Williams & Coleman 2009). The same trend persists when looking at readmissions beyond 3 months after discharge, where among Medicare patients, readmission rates of heart failure patients were up to 60% within 6—9 months of the primary discharge. These readmissions, accounted for 28% of all hospital readmissions, followed by pneumonia at only 4.2% (Aranda, Johnson & Conti 2009). Heart failure exacerbations account for the majority of readmissions among heart failure patients, with reported frequencies of 88.89% within 30 days of discharge, 93.55% within 60 days, and 90.24% within 90 days of discharge, respectively (Van Such, Naessens, Stroebel, Huddleston, & Williams, 2006).

With readmission rate a key outcome indicator for evaluating the quality of care in the heart failure population (Joynt et al., 2011), investigators examined factors related to readmission. A number of predictors of readmission in heart failure patients were identified: being single, male sex, receipt of medical assistance, frequent home address changes, history of cocaine use, multiple previous hospital admissions and emergency presentation between 6 am and 6 pm for the index admission (Amarasingham et al., 2010). Co-morbidities also were reported to be associated with readmission, including renal insufficiency, atrial fibrillation and coronary artery disease (Sherer, Crane & Abel 2011); diabetes, peripheral vascular disease and stroke (Van Such et al., 2006). On the other hand, patients receiving the combination of beta blockers, aldosterone antagonists and either angiotensin converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARB) were found to be at a significantly lower risk of readmission compared to those patients who are not given these drug combination (Annema, Luttik & Jaarsma 2009).

Among strategies to reduce readmission rates in heart failure patients, discharge education about lifestyle, symptom monitoring and medications was associated with significantly lower heart failure and all cause readmissions ($p = 0.035$ and $p = 0.003$, respectively) in a study by Van Such et al. (2006). In addition, Jacobs (2011) attained a 30% reduction in readmission in the first 6 months of implementation of discharge planning protocol in HF patients discharged to nursing facilities reaching a readmission rate of 11.32% ($p = 0.013$). A recent survey of 599 hospitals on successful strategies they use to reduce readmission rates of HF patients showed lower risk adjusted 30 day readmissions rates associated with the following strategies: collaboration with community physicians, making nurses take responsibility for medication reconciliation, arranging for follow up appointments prior to discharge, communicating patients' data directly to the patient's primary physician and assigning staff to follow up on any lab results that arrive after discharge. Yet the magnitude of the effects of these strategies is modest, reflecting the complexity of the disorder (Bradley et al., 2013).

There are no published data about readmission rates of heart failure patients in Lebanon. The aim of this study was to identify the prevalence and causes of readmission among patients admitted with heart failure at Rafic Hariri University Hospital, a large tertiary government hospital in Beirut. Another aim was to identify demographic and clinical predictors of readmission and possible gaps in management that may contribute to these readmissions.

Methods

A retrospective descriptive design was used for this study. The method included medical record review of all consecutive heart failure patients admitted to Rafic Hariri University Hospital in Beirut between January 1st, 2010 and December 31st, 2010. The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki. Approval was secured from the institutional review boards (IRB) of the university and the hospital administration. Inclusion criteria were: (a) patients admitted with a diagnosis of heart failure to the cardiology unit, as referred by a cardiologist from outside clinics or the emergency department; (b) age over 18 years; (c) admission during the year 2010. Patients who passed away during the index hospitalization were excluded.

Sample

The total number of patients admitted under the care of an attending cardiologist during the study period was 2285. These patients were admitted for any cardiac condition including myocardial infarction (MI), angina, heart failure or procedures such as percutaneous coronary interventions, cardiac catheterization or pace maker or implantable cardioverter defibrillator (ICD) insertion. Patients who were admitted for open heart surgery were excluded, thus yielding 2191. Out of the 2191 patients, those who were admitted for a period of less than 24 h, including those who underwent cardiac catheterization, angioplasty or insertion of a pacemaker or an implantable cardioverter defibrillator (ICD) were excluded, leaving 1097 patients. Of the remaining 1097 patients admitted under the care of a cardiologist, 187 were patients with history of heart failure documented in their medical records or were diagnosed for heart failure in this index admission as identified by their symptoms and their diagnostic tests, thus the final sample size was 187 heart failure patients admitted in 2010.

Setting

This study was conducted at Rafic Hariri University Hospital, a 430-bed tertiary care center that is the largest

governmental hospital in Lebanon. The government funding provided for patients admitted to this hospital make patients from all over Lebanon seek it for treatment and hospitalization. It is equipped with a large cardiac care unit with a capacity of 20 beds that are almost always fully occupied. All patients with heart failure are admitted to the coronary care unit and cared for by cardiologists.

Procedure

Data was collected retrospectively from the medical records. The first author, who was a working at the hospital at the time and familiar with their documentation, was the only one who collected the data from the medical files to ensure reliability. Patients' diagnosis of heart failure was identified through the typical heart failure symptoms documented such as dyspnea, orthopnea, peripheral edema, ascites, or arrhythmias on admission, or atypical symptoms confirmed by diagnostic tests, including echocardiography and chest X-ray. The final diagnosis was made in line with the recommendations of the American Heart Association (AHA) [15]. The heart failure assessment recommendations of the AHA include physical examination, history, laboratory tests including complete blood count, urinalysis, serum electrolytes, serum creatinine and blood urea nitrogen, lipid profile, liver function tests and thyroid stimulating hormone, chest X-ray interpreted by a radiologist, echocardiography interpreted by a cardiologist and electrocardiography (ECG) result if available on the system, as well as B-natriuretic peptide (BNP) if available. For the purpose of this study, heart failure diagnosis was confirmed by an ejection fraction (EF) < 40% and labeled as systolic heart failure, or documented diastolic heart failure, and/or echocardiography findings suggestive of heart failure such as global hypokinesia, left atrial and left ventricular dilatation, in addition to symptoms of heart failure and congestion or pulmonary edema on chest radiography.

A data collection tool was developed for this study. Data was entered by hand as the information was retrieved from various sources, both paper and electronic. The form was evaluated for thoroughness by a heart failure specialist. Variables included in this tool were derived from previous work which showed correlation with early readmission. The tool included demographic data, clinical data, admission and readmission dates, discharge medication prescribed at the index admission and other significant variables such as critical events during the index admission that might have affected the patients' outcomes. These variables include intubation, antibiotic administration and inotropes use. Demographic data was collected about age and gender, area of residence, in addition to smoking status and alcohol consumption. Clinical data included ejection fraction, length of stay of the index admission (i.e. the admission with heart failure during 2010), procedures done and treatments provided, including the use of inotropes and diuretics dosing, medications prescribed at discharge, and any documentation of discharge instructions given to the patient. Unfortunately, the New York Heart Association (NYHA) class was not documented in the medical records. The number, dates and causes of readmissions within one year of discharge were collected. Also, medications taken at home between the index hospitalization and first readmission including Digoxin, diuretics, ACE Inhibitors, beta blockers and their doses were collected from the admission sheets of the readmissions.

Statistical analysis

Sample characteristics were analyzed using means and standard deviations as well as frequencies and percentages. Patients who were readmitted were compared with those who were not readmitted on all demographic, clinical and treatment variables using Student *t*-tests and chi squared tests. Variables that were not normally distributed were log transformed to undergo parametric testing. These variables are LOS, creatinine, BUN, HDL, triglycerides, TSH, Gamma GT, troponin and heart rate. The analysis was repeated comparing non-readmitted patients with those readmitted within 90 days of discharge from the index admission. To determine predictors of readmission, a binary logistic regression was performed on relevant variables and those that were significantly different between the readmission groups. Significance level was set at 0.05.

Results

The sample included 187 heart failure patients who were admitted in 2010 to the study hospital. The characteristics of patients are shown in Table 1. The majority of the patients (59.4%) were male, with a mean age of 63.71 (SD 12.87) years (range 23—98). The majority of patients (84.5%) were previously diagnosed cases of heart failure, including 126 (69.6%) that had systolic heart failure, with 56.4% having EF < 35%. In terms of medical history, 61% had hypertension, 50.8% had coronary artery disease (CAD), 41.7% were diabetic, 17.1% had a history of atrial fibrillation, 15% had hyperlipidemia, 11.8% had a history of chronic obstructive pulmonary disease (COPD) and 9.6% had renal diseases. In terms of lifestyle, body mass index ranged between 18.38 kg/m^2 and 48.90 kg/m^2, where 31.7% were overweight, 34.7% were obese and 6.9% were morbidly obese. Seventy-one patients (42%) were current smokers, and only 16.8% consumed alcohol. The length of stay for these patients ranged between 1 and 38 days. In addition 35 (22.7%) of patients had atrial fibrillation documented by ECG at admission and 36 (23.4%) had left bundle branch block. Three patients had ICD inserted and four had pacemakers. None of the patients had the BNP level taken.

Prevalence and causes of readmission

Overall, out of the 187 patients admitted in 2010, there were 72 patients (38.5% of the sample) readmitted within 90 days of their index discharge for all causes, including heart failure and non-heart failure causes. Of the 72 patients, 52 (72.2%) were readmitted once, 16 (22.2%) were readmitted twice, three (4.17%) were readmitted three times and one (1.39) was readmitted four times. Twenty-eight patients (15%) were readmitted within 30 days of the index discharge, 42 (22.5%) within 60 days and 52 (27.8%) within 90 days.

Table 1 Sample characteristics ($N = 187$). All values are frequency and percent except where indicated.

Variable	Frequency	Percent
Type of heart failure		
Systolic	126	69.60
Heart failure new cases	29	15.50
Gender (male)	111	59.40
Age[a]	63.71	12.87
Living at home	187	100.00
Province		
Beirut	84	44.90
Mount Lebanon	74	39.60
North	16	8.50
Bekaa	13	7.00
Smoking status		
Current	71	42.00
Alcohol consumption	20	16.80
Medical history		
Hypertension	114	61.00
Coronary artery disease	95	50.80
Diabetes mellitus	78	41.70
Atrial fibrillation	32	17.10
Hyperlipidemia	28	15.00
Chronic obstructive pulmonary disease	22	11.80
Renal disease	18	9.60
Cerebrovascular accident	13	7.00
Peripheral vascular disease	8	4.30
Implantable cardioverter defibrillator	3	1.60
Pacemaker	4	2.10
Ejection fraction[a]	33.09	13.10
Body mass index[a] (kg/m^2)	29.33	5.95
Length of stay[a] (days)	7.36	6.05

[a] Mean and standard deviation are reported.

Out of the 72 readmitted patients, fifty-three patients (73.61%) were readmitted for heart failure exacerbation, including 41 (56.94%) who were admitted within 90 days, 31 (43.06%) were admitted within 60 days, 20 (27.78%) were readmitted within 30 days. Other causes for readmission included falls/fractures, lower leg ischemia/gangrene, COPD, respiratory failure and renal failure. Moreover, 10 of the 16 patients (62.5%) who were readmitted twice were readmitted for heart failure exacerbation, two out of the three patients readmitted three times presented again with heart failure exacerbation, including one who was readmitted on the same day for heart failure exacerbation.

Heart failure management

During the index admission, the majority of patients received drug therapy with ACE Inhibitors (70.6%) or ARB (12.8%), beta blocker (74.3%), high dose ($\geq$120 mg daily) of Furosemide (43.9%), Spironolactone (36.4%) and Digoxin (26.2%). Twenty-seven patients (14.4%) required inotropes, including 21 (11.2%) who were given Dobutamine, five (2.7%) who were given Dopamine and one (0.5%) who needed Norepinephrine. Nevertheless, the trend for using ACE Inhibitors, ARBs, and beta blockers during the first readmission improved significantly compared to the index admission as they were prescribed more often at readmission. Treatment did not differ between patients with preserved and reduced ejection fraction in this sample. NYHA class was not documented in the medical charts and so was not available for analysis against medication prescription.

The majority of patients were discharged on ACE Inhibitors (63.6%) or ARB (14.4%), beta blocker (71.7%), and high dose of Furosemide (58.3%). Only 60 patients (32.1%) were discharged on Spironolactone and 34 patients (18.2) on Digoxin.

In the 72 patients who were readmitted, when comparing the frequency of medications prescribed at discharge with those reported as taken at home upon readmission, 43 (59.7%) were found to be taking ACE Inhibitors at home out of 47 (65.3%) who were prescribed this medication at discharge from the index admission; 10 (13.9%) were taking ARB vs. eight (11.1%) who were discharged on it; 46 (63.9%) were taking beta blockers vs. 45 (62.5%) discharged on it; 22 (30.6%) were on high dose diuretics out of 40 (55.6%) discharged on it; 19 (26.4%) were taking spironolactone out of the 23 (31.9%) who were prescribed spironolactone upon discharge of the index admission and 10 (13.9%) were on digoxin out of the 14 (19.4%) patients who were discharged on it.

Documentation of discharge education was lacking for the majority of patients in the current sample, where only 4.3% had documented education about diet, symptom management, smoking cessation and medications.

Predictors of readmission

Tables 2 and 3 show the differences in demographic and clinical variables between patients who were readmitted and those who were not readmitted. As shown in Table 2, blood glucose was found significantly higher among the readmitted group compared with the non-readmitted group (141.49 vs. 116.91, $p = 0.04$). Those readmitted tended to have longer length of stay at index admission than their counterparts (8.42% vs. 6.70%, $p = 0.058$). Moreover, when comparing those same variables between patients readmitted for heart failure exacerbation and those who were not readmitted, Na and Cl levels were significantly lower whereas gamma GT was significantly higher in those readmitted with heart failure exacerbation compared to their counterparts, with p values respectively 0.022, 0.022, and 0.027.

Furthermore, as seen in Table 3, those readmitted were significantly more likely to be diabetic (54.2% vs. 33.9%, $p < 0.01$), hyperlipidemic (22.2% vs. 10.4%, $p = 0.028$), and with history of CAD (68.1% vs. 40%, $p < 0.01$), but less likely to be prescribed beta blocker (62.5% vs. 77.4%, $p = 0.028$). The difference by hypertension was borderline significant (69.4% vs. 55.7%, $p = 0.06$). There were no other significant differences in readmission status.

There were 31 patients (16.6%) who were discharged on a combination of spironolactone, beta blocker and ACE Inhibitors or ARB. Comparing those with their counterparts on readmission rates did not show significant difference. Logistic regression was done to identify predictors of readmission in the sample. A number of models were tried with

Table 2 Comparison of clinical variables in the readmitted and not readmitted group.

Variable	Readmitted patients ($N = 72$)		Not readmitted patients ($N = 115$)		P value
	Mean	Standard deviation	Mean	Standard deviation	
Age	65.56	11.26	62.56	13.71	0.121
BMI	29.16	5.90	29.452	6.04	0.810
LOS	8.420	6.70	6.70	5.527	0.023*
Na	136.87	4.90	137.88	3.70	0.135
Cl	100.01	5.91	101.42	5.14	0.087
K	4.56	0.69	4.47	0.74	0.357
Creatinine	1.35	1.06	1. 46	1.97	0.977*
BUN	35.43	31.48	33.69	30.56	0.601*
Cholesterol	170.21	57.46	164.32	45.12	0.492
LDL	107.51	45.11	100.96	40.06	0.338
HDL	36.28	12.73	39.91	40.11	0.949*
Triglycerides	145.34	90.16	133.11	78.07	0.365*
Glucose	141.49	80.33	116.91	51.59	0.047
TSH	1.75	2.09	2.84	5.56	0.163*
Gamma GT	95.31	109.89	64.48	67.92	0.165*
Troponin	0.23	0.57	0.19	0.67	0.249*
SBP	126.24	24.25	126.11	27.59	0.975
DBP	69.77	13.70	73.24	17.72	0.160
HR	91.48	21.55	94.50	24.40	0.431*
WBC	11.02	4.18	10.11	4.08	0.144
Platelets	272.72	95.99	253.20	96.510	0.180

BMI, body mass index; BUN, blood urea nitrogen; DBP, diastolic blood pressure; HR, heart rate; K, potassium level; LOS, length of stay; Na, sodium level; SBP, systolic blood pressure; WBC, white blood cells. P values marked with * are log transformed to become normally distributed, mean and SD presented here before transformation for easier interpretation

Table 3 Comparison of select clinical variables by readmission status.

Variable	Readmitted Patients ($N = 72$)		Not readmitted patients ($N = 115$)		χ^2 value	P value
	Frequency	Percent	Frequency	Percent		
Diabetes Mellitus	39	54.2	39	33.9	7.471	0.006
Hypertension	50	69.4	64	55.7	3.539	0.060
Renal disease	10	13.9	8	7.0	2.446	0.118
History of Atrial fibrillation	14	19.4	18	15.7	0.449	0.503
Bundle branch block (by ECG)	15	23.1	21	23.6	0.006	0.940
COPD	9	12.5	13	11.3	0.061	0.805
Coronary artery disease	49	68.1	46	40.0	13.944	0.000
Cerebrovascular accident	7	9.7	6	5.2	1.389	0.239
Hyperlipidemia	16	22.2	12	10.1	4.832	0.028
Peripheral vascular disease	4	5.6	4	3.5	0.467	0.497
ICD inserted	2	3.8	1	0.9	1.021	0.312
Pacemaker inserted	3	4.2	1	0.9	2.299	0.129
Alcohol use	8	14.8	12	18.5	0.281	0.600
Current smoker	28	39.4	43	43.9	0.333	0.564
Beta blocker	45	62.5	89	77.4	4.835	0.028
Aldactone	23	31.9	37	32.2	0.001	0.974
ACEI	47	65.3	72	62.6	0.136	0.712
ARB	8	11.1	19	16.5	1.049	0.306
Atrial fibrillation (by ECG)	15	23.1	20	22.5	0.008	0.929

ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; COPD, chronic obstructive pulmonary disease; ICD, implantable cardioverter defibrillator.

Table 4 Summary of logistic regression analysis predicting readmission status ($N = 187$).

Variable	B	SE	Wald statistic	*P* value	Odds ratio	CI lower bound
Age	0.015	0.019	0.814	0.367	1.015	0.983—1.049
Diabetes	0.986	0.420	5.502	0.019	2.681	1.176—6.110
CAD	1.194	0.415	8.262	0.004	3.300	1.462—7.449
Log_LOS index	2.060	0.746	7.631	0.006	7.842	1.819—33.809
β Blocker discharge	−0.812	0.440	3.403	0.065	0.444	0.187—1.052
Log_Gamma GT	0.986	0.495	3.965	0.046	2.679	1.016—7.068
Constant	−5.227	1.671	9.787	0.002	0.005	

CAD, coronary artery disease; LOS, length of stay.

variables significantly correlated at the bivariate level and those identified in the literature as predictors. Based on the sample size, the best fitting model included age, history of diabetes, history of CAD, length of stay at the index admission, gamma GT level, and prescribing a beta blocker on discharge. Results are shown in Table 4. All the variables were entered together and the overall model was significant ($\chi^2 = 30.330$, DF = 6, $P = 0.000$). This model had good fit to the data as the Hosmer—Lemeshow test was non-significant ($\chi^2 = 10.039$, df = 8, $p = 0.262$). The model was able to accurately classify 69.1% of the sample overall; however, the classification was more accurate for the non-readmitted (85.1%) compared to the readmitted (42.3%) group. The variance explained by the model is moderate, as suggested by the Nagelkerke R^2 of 0.267, meaning we are explaining 26.7% of the likelihood to be readmitted. As seen in Table 4, those with diabetes were twice more likely to be readmitted, and those with CAD were three times more likely to be readmitted than those without those co-morbidities. Elevated gamma GT and prolonged length of stay predicted more likelihood for readmission. Those discharged on beta blockers tended to be less at risk for readmission, though this variable did not reach statistical significance ($p = 0.065$). Age did not predict readmission.

Discussion

When comparing the readmission rates of this study with the literature, we found that our rates at 30, 60 and 90 days fall between those reported by other investigators. The overall readmission rate (38.5%) was lower than that reported by Barretto et al. (2008) who reported 42.5% over one year follow up. The current sample seems to be relatively hemodynamically stable, thus less sick than the sample of Barretto and colleagues where his sample had lower EF and required three times more consumption of inotropes compared to the sample in this study [16], which may explain the lower readmission rate found in this current study.

As is the case for all cause readmission rates, the percent of readmissions due to heart failure exacerbation differed a lot between studies, from 27% by McDermott et al. (1997). McDermott et al. (1997) at 1.61 years follow up to 90.24% by Van Such et al. (2006). Van Such et al. (2006) at 90 days post-discharge. In the current study, the overall percentage of those readmitted for heart failure exacerbations was 73.61%. McDermott's sample (McDermott et al., 1997) was older, with more cardiovascular and pulmonary morbidity than the sample in this study. Overall, the majority of patients were readmitted for heart failure exacerbation in this sample. It may be that the outpatient management of these patients following discharge such as titration of medications is suboptimal or lack of adherence of patients to the medications prescription. No data was collected to verify these possibilities.

McDermott et al. (1997) found that patients who had not had their left ventricular ejection fraction (LVEF) assessed in the past 6 months were significantly more likely to be readmitted within 30 days of their discharge ($p = 0.04$). This finding was replicated in the current study with $p = 0.032$, highlighting the importance of monitoring left ventricular EF in these patients regularly. The AHA guidelines state the importance of repeated measurement of LV function with any change of clinical status of the patient; however, no assessment is required when no deterioration is noticed on these patients (Yancy et al., 2013).

ACE I or ARB administration was shown to be associated with slowing the progression of the disease and decreasing hospital admissions (Krum et al., 2006) and is the mainstay of heart failure management according to the guidelines of the American Heart Association (Jessup et al., 2009), cardiac Society of Australia and New Zealand (Krum et al., 2006) and the European Society of Cardiology (Dickstein et al., 2008). In this study, only 77% of the discharged patients were on ACE or ARB (63.6% and 14.4%) respectively. Moreover, only 23 (18.1%) of those having heart failure reduced ejection fraction were discharged on the combination of ACE I or ARB with beta blocker and spironolactone. This suggests the need of improvement in the application of evidence based guidelines in the management of heart failure. Moreover, beta blocker use was found to be significantly associated with less likelihood for readmissions in the bivariate analyses ($p = 0.028$).

At the bivariate level of analysis, those with diabetes, coronary artery disease (CAD), hyperlipidemia, and higher levels of glucose were at risk for readmission. Also those with prolonged length of stay tended to be at higher risk for readmission. When comparing patients readmitted for heart failure exacerbations to those not readmitted, patients with hypertension, diabetes, CAD and lower levels of sodium, chloride and higher levels of gamma GT were at higher risk of readmission. Gamma GT denotes liver congestion, which is associated with right sided heart failure. These patients usually have poorer prognosis, which explains why elevated Gamma GT predicted higher readmission rate.

Some limitations in this study are worth discussing. The first limitation relates to the use of retrospective data, over which one has no control, thus introducing information is depending on the accuracy of documentation. For instance, an admission diagnosis of heart failure was not always explicitly stated on admission, so to make sure no cases are missed the whole chart was reviewed, including the discharge summary for the definite diagnosis. The ECG diagnosis was not always written on the ECG sheets, so the third author interpreted all patients' ECGs to ensure accuracy in identifying atrial fibrillation. Another limitation is the use of a retrospective cohort design, which may lead to a selection bias as opposed to a case control design for instance. Nevertheless, the aim was to capture all the cases of heart failure admitted during the study period retrospectively and gather all relevant data about them accurately, including their readmission status; this approach does limit the risk of this bias. Further, comparing those admitted and those who were not in relation to their demographic and clinical variables provided a good overview of the cases and their controls imitating a case—control approach. Considering that there are no previous data in Lebanon on readmission rates among the heart failure population and no available national database or registry, a retrospective approach was followed to provide a brief understanding of the variables leading to this early readmission and its causes and predictors. Another major limitation was the lack of follow up of discharged patients who were not readmitted, for they were assumed in good health if not readmitted. This may not be accurate since they could have been readmitted to another hospital or may have passed away. After conducting their study, McDermott et al. (1997) contacted 10% of the sample to check for readmissions to other hospitals. The investigators found that their results were reliable, for the majority (84%) was not readmitted during the study period to another hospital. Furthermore, since the current study hospital is a governmental hospital where patients are unlikely to seek other hospitals for financial reasons, it is assumed that the results are reasonably accurate, although one cannot predict death or wellbeing. The lack of documentation of discharge instruction limits drawing conclusions about the adequacy of discharge education for these patients, considering the reported association of discharge instruction with lower readmission rates in the literature (Van Such et al., 2006). However, the anecdotal evidence based on the first author's experience in that setting suggests that all patients are provided with prescriptions and education about their medication administration, but this is not the case with other items of self-care education such as weight monitoring, fluid and salt intake, etc.

Conclusion

Management and care for the patients did not always conform to the evidence based guidelines such as the proper cardiac assessment including echocardiography during hospitalization and medication prescription at discharge, namely beta blocker; this finding is supported by the finding in the regression model where patients on beta blockers were less likely to be readmitted. The findings suggest the need for better adherence to clinical guidelines in the management of heart failure patients and improved documentation of discharge instructions. The significant findings between the readmitted and the non-readmitted group were also in their co-morbidities, where data needs to be gained in future studies to assess the management of these co-morbidities and subsequent impact on heart failure outcomes. Further, prospective studies provide better follow up and more accurate findings to reach valid conclusions. Discharge instructions should be integrated in the discharge planning as the latter was found to impact readmission rates (Jacobs, 2011; Van Such et al., 2006). Moreover, programs assessing the culturally appropriate approaches in the management of this health condition should be investigated to reach better outcomes. In terms of practice, both physicians and nurses need to be up to date on heart failure management guidelines. Yearly conferences and awareness campaigns on heart failure have been implemented in Lebanon in the past five years by the heart failure interest group of the Lebanese Society of Cardiology, including teaching primary physicians about medication titration. With more education and training of nurses, better discharge instruction can be achieved.

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