Original Article

Prevalence of co-morbid conditions in Heart failure: an experience at tertiary care hospital

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Abstract

Introduction

Patients with heart failure (HF) have various co-morbidities that complicate management and may adversely affect outcomes. HF guidelines provide little discussion on this topic and evidence is sparse.

Material and Methods

This is a descriptive cross-sectional study on 240 consecutive patients with HF admitted from September 2016 to July 2017 at B.P. Koirala Institute of Health Sciences (BPKIHS), Nepal. All patients admitted with diagnosis of HF with reduced or preserved ejection fraction (NYHA functional class III/IV) based on Framingham Criteria and echocardiography assessments were included. Pre-defined co-morbid conditions were assessed.

Results

Mean age of patients was 53.5 years and 53% were female. Most patients were in NYHA class III or IV (25% and 75% respectively) and 28.3% had ischemia as a cause of HF. Among co-morbidities, 85% of patients with HF had at least one co-morbidity. Anemia (68.3%), coronary artery disease (30.4%), hypertension (26.6%), diabetes (18.7%) and chronic kidney disease (7.5%) were the co-morbidities with the highest prevalence. Chronic obstructive pulmonary disease (3.7%), sleep apnea (2.5%), hypothyroidism (2.5%) and stroke (2.5%) were less common. Of all patients, only 15% had no co-morbidity, 40% had one co-morbidity, 22% had two co-morbidities, and 13 % had three or more co-morbidities.

Conclusion

Co-morbidities are common problems and anemia is the most common in our scenario which could be of multi-factorial etiology. Careful attention to the diagnosis and management of specific co-morbidities may help to improve outcomes in patients with HF.

Keywords:

Co-morbidities, Heart failure, Prevalence

Introduction

HF is a clinical syndrome which is characterized by the heart's inability to meet the body's circulatory demands. HF is associated with high morbidity and mortality and poor quality of life [1]. There is increasing evidence that co-morbidities frequently accompany HF and lead to increased morbidity and mortality and a further decrease in quality of life [2]. Hospitalization rates are increased in the presence of co-morbidities.

The term co-morbidity can be defined as a medical condition existing simultaneously, is caused by or is otherwise related to another condition in the same patient [3].

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High prevalence of co-morbidities in patients with HF suggests a common risk factor or a causal relationship. It is believed that HF itself could be a cause of multiple other co-morbid illnesses [4].

In general, the prevalence of co-morbidities is high across all western studies [5,6]. There is paucity of data on these areas from our part of the world. Thus, this study was carried out to have insight about patterns of co-morbidities that will help to early recognition and treatment of these conditions.

Material and Methods

This is a cross sectional observational hospital-based study. Total of 240 consecutive patients (age ≥ 16 years) with diagnosis of HF who were admitted from September 2016 to July 2017 at division of cardiology, internal medicine ward of BPKIHS, Nepal were included in the study. The aim was to identify the pre-defined co-morbid conditions and their prevalence in patients suffering from HF. All patients admitted with diagnosis of HF with reduced or preserved ejection fraction (NYHA functional class III/IV) based on Framingham Criteria and echocardiography assessment were included.

Clinical and demographic variables were noted at admission which included age, gender, underlying etiology of HF and associated co-morbidities. Particular emphasis was given to pre-specified cardiac and extra-cardiac co-morbid conditions that directly or indirectly impact the manifestations of HF and its prognosis. Ethical approval was obtained from institutional ethical review board (IERB) prior to beginning the study. Collected data were entered in Microsoft Excel 2007 and converted into SPSS 21 version. For descriptive statistics: percentage, mean, standard deviation, interquartile range was calculated. Graphical and tabular presentation was made as necessary.

Results

The mean age of 240 patients was 53.5 (range 16-90) years and 53% were female. Most patients were in NYHA class III or IV (25% and 75% respectively) and 28.3% had an ischemic cause of heart failure. Eighty-seven (36.2%) patients were current cigarette smokers and 6.6 % had a significant history of alcohol consumption. Table 1 shows baseline characteristics of the study population. Among the co-morbidities, 85% of patients with HF had at least one co-morbidity. Anemia (68.3%), coronary artery disease (30.4%), hypertension (26.6%), diabetes (18.7%) and chronic kidney disease (7.5%) were the co-morbidities with the highest prevalence (Table 2). Chronic obstructive pulmonary disease (COPD) [3.7%], sleep apnea (2.5%), hypothyroidism (2.5%) and stroke (2.5%) were less common. Of all patients, only 15% had no co-morbidity, 40% had one co-morbidity, 22% had two co-morbidities, and 13% had three or more co-morbidities.

Among electrocardiographic abnormalities, around a third of patients had tachycardia, 25% had left ventricular hypertrophy, 23.3% had atrial fibrillation and 11% demonstrated inter ventricular conduction delay. Echocardiography revealed LV systolic and diastolic dysfunction in 75% and 82% of patients respectively, mitral regurgitation in 52%, right ventricular dysfunction in 24% and moderate to severe pulmonary artery hypertension in 86% of patients (Table 4).

Table 1: Clinical characteristics of patients with heart failure (n = 240)

Age in year (mean and range)	53.5 (16-90)
Male Female	113 (47 %) 127 (53 %)
Heart rate in bpm (mean and range) Tachycardia (Heart rate > 100 bpm)	94 (60-160) 72 (30.6%)
Blood pressure in	

mmHg(Mean and Range) Systolic Diastolic	112.4 (60-210) 72 (40-100)
Presenting symptoms at admission Dyspnea (NYHA class) IVIII Fatiguability Palpitation	180 (75%) 60 (25%) 98 (40.8%) 20 (8.3%)
Clinical signs Crackles Edema Raised JVP	219.1 (91.3%) 187.4 (78.1%) 160.5 (66.9%)

LVH 60(25%)	Moderate to severe PAH 207 (86%)
AF 56(23.3%)	LVDD 197 (82%)
LBBB 16(6.6%)	MR 125(52%)
RBBB 10(4.1%)	RV dysfunction 58 (24.1%)

Abbreviations: AF: Atrial fibrillation, RBBB: right bundle branch block, LBBB: Left bundle branch block, LVH: Left ventricular hypertrophy, LVEF: Left ventricular ejection fraction, PASP: Pulmonary artery hypertension, RV: Right ventricle, MR: Mitral regurgitation, LVDD: Left ventricular diastolic dysfunction
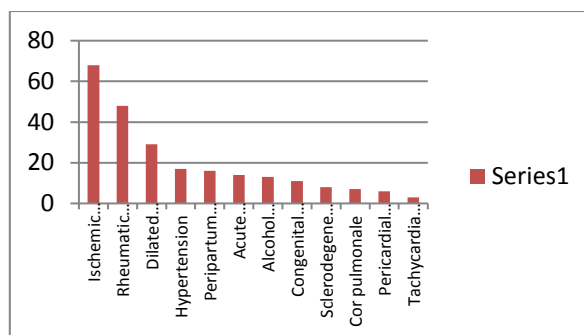
Table 2. Co-morbidities of patients with heart failure

Anemia	164 (68.3%)
Coronary artery disease	73 (30.4%)
Hypertension	64 (26.6%)
Type 2 diabetes mellitus	45 (18.7%)
Chronic kidney disease	18 (7.5%)
Chronic obstructive pulmonary disease	9 (3.7%)
Sleep apnea	6 (2.5%)
Stroke	6 (2.5%)
Hypothyroidism	6(2.5%)
Hyperthyroidism	3(1.25%)
Bronchial asthma	3(1.25%)
Hyperuricemia	3(1.25%)
Pulmonary embolism	3 (1.25%)

Figure 1. Etiologies of heart failure.

Table 3. Acute organs dysfunction and electrolytes imbalance in patients with heart failure

Organs dysfunction Acute Kidney injury Hepatitis	33 (13.7%) 18 (7.5%)
Electrolytes imbalance Hyponatremia Hyperkalemia Hypernatremia Hypokalemia	60 (25%) 19 (7.9%) 17 (7.08%) 17 (7.08%)

Table 4. Electrographic and Echocardiographic co-morbidities in patients with heart failure

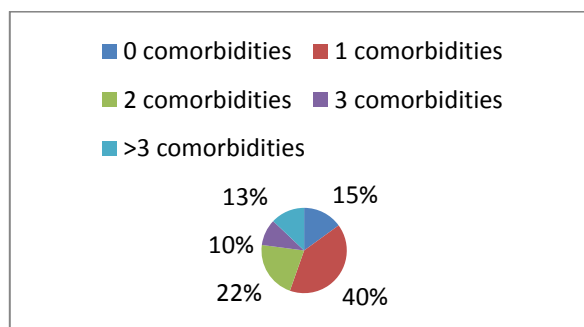| Electrocardiogrphic findings	Echocardiographic findings
Tachycardia (>100) 74 (30.8%)	LVEF: Reduced 180 (75%) Normal (≥ 55%) 60(25%)

Figure 2. *Prevalence of co-morbidities in patients with heart failure.*

Discussion

This study focuses on co-morbidities of patients with HF of different etiologies. We found that the majority of patients had at least one co-morbid condition. Anaemia, coronary artery disease, hypertension and

diabetes were the most common co-morbidities in our patients, along with COPD and chronic kidney disease which were less common. These findings are consistent with other studies [7, 8]. In developed countries, CAD leading to ischemic cardiomyopathy remains the commonest cause of HF as in our study. However, rheumatic heart disease leading to HF is more prevalent in this part of the world and we found 20% of patients hospitalized with HF had rheumatic heart disease. Table 5 shows the comparison of characteristics and prevalence of Co-morbidities in patients with HF among different studies from Nepal and western world.

Various studies show a high prevalence of co-morbidities in patients with HF. Although co-morbidities might cause HF, it is likely that HF itself could be a cause of multiple other co-morbidities [4]. Organs in HF may be affected by impaired haemodynamics, reflected by elevated systemic and pulmonary venous pressure, among other factors which plays a pathophysiologic role in renal and liver dysfunction [9]. In our study, acute kidney injury and congestive hepatitis were present in 13.7% and 7.5% patients respectively.

Anemia in patients with HF has been shown to be independently associated with increased risk of hospital admission and all-cause mortality. Prevalence of anemia in patients with HF and low ejection fraction range widely from 4% to 61% (median 18%) [10]. The most common co-morbid condition in our study was anemia (68.3%). The high prevalence of anemia in general population in Nepal may have contributed to the high prevalence [11].

Framingham Study [12] shows that hypertension is the commonest (75%) underlying disease contributing to congestive HF. In contrast, hypertension was reported to be the primary etiological factor in only 4% of HF patients in an overview of 31 studies [13]. In our study; however, only 26.65 % of HF patients had hypertension as a co-morbid condition indicating lower prevalence than western population.

Diabetes mellitus (DM) is associated with increased morbidity and mortality in patients with HF and it may complicate the clinical course of HF through different mechanisms, including electrolyte disturbances, increasing infection risk and altered drug absorption as well as through ischemia and other direct adverse effects on the myocardium [14]. We found 18.3 % of patients hospitalized with HF had Type 2 diabetes mellitus as comorbid condition.

Renal impairment is an established risk factor for adverse outcome in patients with HF [15]. Acute Decompensated Heart Failure National Registry (ADHERE) showed that more than half of acute HF patients had at least moderate renal insufficiency on admission which was associated with increased mortality [5]. We found that 13.7 % of patients hospitalized with HF had chronic kidney disease and 7.5% patients had acute kidney injury as comorbid condition.

COPD is found in approximately one-third of HF patients, with a slightly higher prevalence in HF with preserved ejection fraction (HFpEF) patients compared with HF with reduced ejection fraction (HFrEF) patients [16]. In our study, only 3.7% of patients with HF had COPD possibly due to under diagnosis and 26% of patients were current smoker. The specific rationale for the increased prevalence in HFpEF patients is unclear. COPD was suggested to cause proinflammatory state leading to endothelial and myocyte dysfunction with resultant myocardial fibrosis and clinical HFpEF [17].

The pathophysiology of HF along with HF therapies make patients prone for electrolyte disturbances, commonly found

are hyponatremia, hypokalemia and hypomagnesemia [18]. An understanding of the development and nature of electrolyte disturbances gives insight about pathophysiology of HF. It also increases one's sensitivity to the presence of this condition and provides the management rationale. In our study, hyponatremia (25%) was relatively common as compared to other electrolytes disturbances.

Table 5. Comparison of characteristics and prevalence of co-morbidities in patients with heart failure among different studies.

Characteristics	ADHERE registry, 2001-2004 [5]	OPTIMIZE-HF registry, 2003-2004 [6]	Dubey L et al 2010-2012 [19]	Shrestha UK et al, 2015 [20]	Our study 2016-2017
HF population	105,388	48,612	255	264	240
Mean age (years)	72.8+_14.1	73.2	57(11-95)	63.7	53.5
Male: Female ratio	49:51	48:52	62:38	40.5:59.5	47:53
Race	Caucasian, African American	Caucasian, African American	Nepalese	Nepalese	Nepalese
HFrEF	50	49	62	-	75
HFpEF	50	51	38	-	25
Risk Factors and co-morbidities					
Hypertension (%)	69-77	23	-	54.2	26.6
Type 2 Diabetes mellitus (%)	40-46	42	-	14.8	18.7
COPD (%)	27-33	28	-	17.1	3.7
Smoking (%)	-	17	31	67.4	36.2
Significant alcohol use (%)	-	-	-	14.4	6.6
Mean hemoglobin (gm/dl)	-	12.5	-	12.8	
Mean serum creatinine (mg/dl)	HFrEF: 1.6±1.3 HFpEF: 1.7±1.5	1.4 (1.1-1.9) 1.3 (1.0-1.8)	-	1.4	1.29
Atrial Fibrillation (%)	17-21	31	-	21.3	23.3
Etiology of Heart failure					
CAD (%)	50-61	46	36.5	29.5	30.4
RHD (%)	-	-	25.5	8.7 (VHD)	20
DCM (%)	-	-	14.5	21.6	12
CHD (%)	-	-	2.7	-	4.5
Cor pulmonale (%)	-	-	12.2	15.5	2.9

Limitations:

This was a hospital-based study in limited number of patients with inclusion of symptomatic patients only. Diagnosis of ischemic heart disease was based on history, risk factors, wall motion abnormality in echocardiography and may not be perfect because lack of coronary angiography in all cases. Similarly, distinction between AKI and CKD may not be correct owing to lack of previous renal function status and follow up data. Data on some of the co-morbid conditions like obesity, depression, musculoskeletal problems are missing.

Clinical Implications:

Although the presence of various co-morbid conditions associated with HF is common in clinical scenario, HF guidelines provide little discussion on this area and the evidence is lacking and mostly observational. Presence of one or more co-morbid conditions like anemia, hypertension, diabetes etc. increases the morbidity and mortality in patients with HF. There is a need for a critical reappraisal of

management strategies in patients with HF in which clinicians target co-morbid conditions along with focusing the underlying cardiac dysfunction.

Conclusion

Majority of patients with HF have one or more co-morbid condition with an increased prevalence of anemia, hypertension, diabetes mellitus and renal dysfunction in the form of acute kidney injury or chronic kidney disease. Anemia is the most common co-morbid condition in our scenario which could be of multifactorial etiology and needs especial mention. Careful attention to the diagnosis and management of specific co-morbidities in HF patients may help to improve patient outcomes.

Ethical Clearance

The study was approved by IERB of B.P. Koirala institute of health sciences prior to beginning of the study.

Competing interests

None declared

References

[1]   McMurray JV, Adamopoulos S, Anker SD, Auricchio A,Bohm M, Dickstein K et al. ESC guidelines for the diagnosis and treatment of acute and chronic heart failure 2012,European Heart Journal. 33(2012)1787–1847.

[2]   Braunstein JB, Anderson GF, Gerstenblith G, Weller W, Niefeld M, Herbert R et al. Non-cardiac comorbidity increases preventable hospitalizations and mortality among Medicare beneficiaries with chronic heart failure,J Am Coll Cardiol.42 (2003)1226-33.

[3]   Valderas JM, Starfield B, Sibbald B, Salisbury C, Roland M. Defining comorbidity: implications for understanding health and health services, Ann Fam Med. 7 (2009) 357-63.

[4]   van Deursen VM, Damman K, van der Meer P, Wijkstra PJ, Luijckx GJ, van Beek Aet al. Co-morbidities in heart failure, Heart Fail Rev. 19 (2014) 163-72.

[5]   Yancy CW, Lopatin M, Stevenson LW, De Marco T, Fonarow GC, ADHERE Scientific Advisory Committee and Investigators. Clinical presentation, management, and in-hospital outcomes of patients admitted with acute decompensated heart failure with preserved systolic function: a report from the Acute Decompensated Heart Failure National Registry (ADHERE) Database, J Am Coll Cardiol. 47 (2006) 76-84.

[6]   Fonarow GC, Stough WG, Abraham WT, Albert NM, Gheorghiade M, Greenberg BH et al, OPTIMIZE-HF Investigators and Hospitals. Characteristics, treatments, and outcomes of patients with preserved systolic function hospitalized for heart failure: a report from the OPTIMIZE-HF Registry, J Am Coll Cardiol. 50 (2007) 768-77.

[7]   van Deursen VM, Urso R, Laroche C, Damman K, Dahlstrom U, Tavazzi L et al. Co-morbidities in patients with heart failure: an analysis of the European Heart Failure Pilot Survey, European Journal of Heart Failure. 16 (2014) 103-11.

[8]   Groenveld HF, Januzzi JL, Damman K, van Wijngaarden J, Hillege HL, van Veldhuisen DJ, et al. Anemia and mortality in heart failure patients a systematic review and meta-analysis, J Am Coll Cardiol. 52 (2008) 818-27.

[9]   Damman K, van Deursen VM, Navis G, Voors AA, van Veldhuisen DJ, Hillege HL. Increased central venous pressure is associated with impaired renal function and mortality in a broad spectrum of patients with cardiovascular disease, J Am CollCardiol. 53 (2009) 582-88.

[10]   Yi-Da Tang, Stuart D. Katz. Anemia in chronic heart failure. Prevalence, etiology, clinical correlates and treatment options,Circulation. 113 (2006) 2454-61.

[11]   Ministry of Health and Population (MOHP) [Nepal], New ERA, and ICF International Inc. 2012. Nepal Demographic and Health Survey 2011. Kathmandu, Nepal: Ministry of Health and Population, New ERA, and ICF International, Calverton, Maryland.

[12]   McKee PA, Castelli WP, McNamara PM, Kannel WD. The natural history of congestive heart failure;the Framingham study, N Engl J Med. 285 (1971)1441-6.

[13]   Teerlink JR, Goldhaber SZ, Pfeffer MA. An overview of contemporary etiologies of

congestive heart failure, Am Heart J. 121 (1991) 1852-53.

[14] Mentz RJ, Felker GM. Noncardiac comorbidities and acute heart failure patients, Heart Fail Clin. 9 (2013) 359-67.

[15] Hillege HL, Nitsch D, Pfeffer MA, Swedberg K, McMurray JJ, Yusuf S, et al. Candesartan in Heart Failure: Assessment of Reduction in Mortality and Morbidity (CHARM) Investigators. Renal function as a predictor of outcome in a broad spectrum of patients with heart failure, Circulation. 113 (2006) 671-8.

[16] Hawkins NM, Petrie MC, Jhund PS, Chalmers GW, Dunn FG, McMurray JJ. Heart failure and chronic obstructive pulmonary disease: diagnostic pitfalls and epidemiology, Eur J Heart Fail. 11 (2009) 130-9.

[17] Paulus WJ, Tschope C. A novel paradigm for heart failure with preserved ejection fraction: comorbidities drive myocardial dysfunction and remodeling through coronary microvascular endothelial inflammation, J Am Coll Cardiol. 62 (2013) 263-71.

[18] Dei Cas L, Metra M, Leier CV. Electrolyte Disturbances in Chronic Heart Failure: Metabolic and Clinical Aspects, Clin. Cardiol.18 (1995) 370-76.

[19] Dubey L, Sharma SK, Chaurasia AK. Clinical profile of patients hospitalized with heart failure in Bharatpur, Nepal,J Cardiovasc Thorac Res. 4 (2012) 103-5.

[20] Shrestha UK, Alurkar VM, Baniya R, Barakoti B, Poudel D and Ghimire S. Profiles of heart failure in the western region of Nepal: prognostic implications of the MELD-XI score, Intern Med Inside. 3 (2015)1.

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