Risk Factors and Prescribing Pattern among Congestive Heart Failure Patients: A Retrospective Study in Tertiary Care Hospital

Manali Ramprasad Latha[1], Mohammad Rafeez[1], Reshma Ann Manoj[1], Uday Venkat Mateti[1,*], Subramanyam Kodangala[2], Shraddha Shetty[3], Raushan Kumar Chaudhary[1]

[1]Department of Pharmacy Practice, NGSM Institute of Pharmaceutical Sciences, NITTE (Deemed University), Mangaluru, Karnataka, INDIA.
[2]Department of Cardiology, K S Hegde Medical Academy, Justice K S Hegde Charitable Hospital, NITTE (Deemed University), Mangaluru, Karnataka, INDIA.
[3]Department of Biostatistics, K S Hegde Medical Academy, NITTE (Deemed University), Mangaluru, Karnataka, INDIA.

ABSTRACT

Background: Congestive heart failure is a progressive clinical syndrome that impairs the ability of heart to pump blood at sufficient rate to meet the metabolic demands of the body. The present study aims to study the prescription patterns and risk factors associated with congestive heart failure (CHF). **Methods:** A retrospective study was conducted in the Cardiology Department of a Charitable Hospital, Mangaluru for the duration of six months. The data of heart failure patients of last ten years (December 2011- December 2020) admitted in the inpatients setting between the 18-90 years of age were included in the study irrespective of the gender. **Results:** CHF was most prevalent among male (60.5%) than the females (39.5%) with mean age of 59.05 ±13.34 years. The most common risk factors associated with CHF were hypertension (57.8%), male gender (56.8%), IHD (53.6%), and age (47.3%). The study showed that 59.1% had 3-5 risk factors. The most commonly prescribed HF drugs were furosemide (53.7%) followed by torsemide (39%), Ipratropium bromide + levosalbutamol (25.34%), aspirin (24.8%), Budesonide (24.4%),

ramipril (22.9%), aspirin + atorvastatin (22.9%), clopidogrel (20.6%), and spironolactone (20.2%) etc. respectively. **Conclusion:** Hypertension, male gender, age, and IHD were identified as the most common risk factors. Diuretics and other cardiovascular agents along with the bronchodilators are the core part of the treatment strategies along for the management of congestive heart failure. Thus understanding about the risk factors and trends in prescribing is vital for positive clinical outcome.

Key words: Risk factors, Prescription patterns, Retrospective study, Heart failure, Cardiology.

Correspondence

Dr. Uday Venkat Mateti,

Department of Pharmacy Practice, NGSM Institute of Pharmaceutical Sciences, Nitte (Deemed to be University), Mangaluru-575018, Karnataka, INDIA.

Email id: udayvenkatmateti@gmail.com

INTRODUCTION

Congestive heart failure is a progressive clinical syndrome that impairs the ability of heart to pump blood at sufficient rate to meet the metabolic demands of the body.[1] New York Heart Association (NYHA) has classified heart failure into four classes (I-IV) based on the onset of symptoms at ordinary activity or at rest.[2] However, recently proposed classification of heart failure is based on ejection fraction i.e. heart failure with reduced ejection fraction (HFrEF), heart failure with preserved ejection fraction (HFpEF) and heart failure mid-range ejection fraction (HFmrEF).[3] Heart failure is categorized into four stages (A, B, C and D) based on its evolution and progression by the American Heart Association, i.e., Stage A: Patients at high risk of heart failure without symptoms/structural heart disease; Stage B: Patients having structural heart disease without symptoms; Stage C: Patients having structural heart disease along with symptoms and Stage D: Patients having refractory heart failure which needs modified interventions.[4]

Burden of heart failure accounts around 26 million people globally and prevalent in about 1% Indians with 0.1-0.16 million death per year.[5,6] This imposes a huge economic burden accounting about 108 billion dollar per annum among Indians.[7] Common locations reporting heart failure mortality are USA, Canada, India and Israel.[8] CHF is caused by structural abnormalities, functional abnormalities and other triggering factors. The predominant predisposing factors for heart failure are hypertension, ischemic heart disease, rheumatic heart disease, congenital cardiovascular disease, diabetes mellitus, nutritional deficiencies and

other extra-cardiac diseases like thyrotoxicosis, obesity, severe anemia, thiamine deficiency and pregnancy.[9]

The main treatment goals are to abolish symptoms, decrease hospitalizations, avoid complications, improve quality of life and prolong survival.[10] The pharmacological management of heart failure includes diuretics, angiotensin-converting enzyme inhibitors, beta- adrenergic blockers, aldosterone antagonist, anticoagulants, and inotropic agents.[11] National guidelines by AHA serves as basis of heart failure therapy i.e. Stage A: reduction of risk factors and aggressive treatment of co-morbidities, stage B: reduction of aggressive factors with an angiotensin-converting enzyme inhibitor/angiotensin-receptor blocker (ACEI/ARB) and/or beta-blocker, stage C: Combination goal-directed therapy with ACEI/ARBs, beta-blockers, and loop diuretics for fluid retention, stage D: Goal-directed medical therapies indicated for stage C and consideration for heart transplantation. In patients with advanced disease and decreased life expectancy, palliative care discussions and advance directive planning should be considered.[12] The current study seeks to include a detailed understanding of the risk factors and medications used among the treatment of CHF patients.

MATERIALS AND METHODS

A retrospective study was conducted in the Cardiology Department of a Charitable Hospital, Mangaluru for the duration of six months. The study was initiated after the approval from the Institutional Ethics Committee (Ref. No: NGSMIPS/IEC/12/2020) and further registered

in Clinical Trial Registry-India (CTRI/2020/12/029738). The calculated sample size of the study was 217 using "n-master software of version 2" with expected proportion of ACE-I = 11.8%; expected precision = 4.3 at 95% confidence interval. The data of heart failure patients of last ten years (December 2011- December 2020) admitted in the inpatients age between 18-90 years were included in the study irrespective of the gender. The data from the incomplete case file, patients discharged against medical advice, patient died during treatment and data of pregnant and lactating women were excluded from the study. The data of the patients on the risk factor and prescribing pattern was collected using the self designed data collection form containing demographic details, checklist of modifiable and non-modifiable risk factors, name and class of the medications prescribed. Further the data on risk factor and prescribing pattern were analyzed using Microsoft excel.

RESULTS

Out of total 511 patients admitted in past ten years, we analyzed data of 217 patients based on the inclusion criteria. Out of 217 patients, male 133 (61.3%) predominates over the female 84 (38.7%) patients with the mean age of 59.05 ±13.34. The majority of the patients were from the 51-65 years of age group. Hypertension, IHD and diabetes were the top three frequently associated co-morbidities among the patients. Similarly, congenital heart disease, cerebrovascular accident and atrial fibrillation were the least prevalent found co-morbidities respectively. Further, Majority (80.18%) of the patients were having 2-5 co-morbid conditions (Table 1).

The patient's data were analyzed for the modifiable and non-modifiable risk factors. Out of 217 patients, 210 were associated with either of the risk factors. Among the modifiable risk factors, Hypertension 127 (57.8%), Ischemic Heart Disease 118 (53.6%), Diabetes 76 (34.5%) were top three and Prolonged stress 4 (1.8%), Depression 3 (1.4%), Rheumatoid arthritis 2 (0.9%) were the least three risk factors. Similarly, the top three non-modifiable risk factors associated with patients were age (47.3%), being male (56.8%) and congenital heart disease (3.2%) respectively (Table 2).

Total 13 classes of medications were prescribed for the CHF patients (Table 3) out of which four major classes specific to CHF were detailed (Table 4) i.e. cardiovascular agents (Diuretics, beta-blockers, ACEI, ARNI, ARB, CCB, alpha-blockers, anti-arrhythmic agents, nitrates), anticoagulants, statins, anti-platelets and bronchodilators. The most commonly prescribed HF drugs were furosemide (53.7%) followed by torsemide (39%), Ipratropium bromide + levosalbutamol (25.34%), aspirin (24.8%), Budesonide (24.4%), ramipril (22.9%), aspirin + atorvastatin (22.9%), clopidogrel (20.6%), and spironolactone (20.2%) etc. respectively.

DISCUSSION

The present study addressed the risk factors associated with CHF and the trends of prescribing the CHF specific medications along with the gender, age and co-morbidity associated with CHF. Out of data of 217 patients in our study, male 133 (61.3%) predominates over the female 84 (38.7%) patients with the mean age of 59.05 ±13.34, with the highest number of patients (39.1%) falling under the age group of 51-65 years which is similar to a study conducted by Baskota *et al.,* where 45% of the subjects were in the age group of 45-65 years.[13] This group was found to be more susceptible to heart failure. Further, In contrast to our study, a Vietnamese study conducted by Nguyen *et al.,* shows that the mean age group affected by HF is 67.6 years and the majority of patients (60%) are above 65 years of age.[14] In the current study, the most observed co-morbidity in CHF is found to be Hypertension (60.9%) followed by IHD (47.3%) and Diabetes (35.9%) which is in parallel to a study

Table 1: Demographic details and co-morbidities.

Characteristics	Number of patients (%)
Gender	
Male	133(61.3%)
Female	84 (38.7%)
Age wise	
18-35	9(4.1%)
36-50	50(22.7%)
51-65	86(39.1%)
>65	72(32.7%)
Co-morbidities condition	
Acute Coronary Syndrome	5(2.3%)
Atrial fibrillation	30(13.6%)
Cardiomyopathy	40(18.2%)
Diabetes	79(35.9%)
Cerebrovascular accident	3(1.4%)
Congenital heart disease	2(0.9%)
Hypertension	134(60.9%)
Ischemic Heart Disease	104(47.3%)
Myocardial Infarction	5(2.3%)
Valvular heart disease	26(11.8%)
Others *	150(69.1%)
Number of co-morbidities	
No comorbidities	5(2.3%)
Single comorbidity	26(11.8%)
2-5 comorbidities	174(80.18%)
>5 comorbidities	12(5.52%)

*Acute kidney injury, anaemia, asthma, bronchitis, chronic obstructive pulmonary disease, chronic kidney disease, chronic liver disease. Delirium, hepatits, hyperthyroidism, hypothyroidism, lower respiratory tract infection (LRTI), osteoarthritis, lung fibrosis, pancreatitis. Pneumonia, pulmonary oedema, tuberculosis, urinary tract infection, thrombosis

by Gonzalez *et al.,* where co-morbidities like Hypertension (60%), IHD(42%) and Diabetes (46%) were most prevalent.[15] Similarly, Lund *et al.,* also found Hypertension (70%) is followed by IHD (33%) and Diabetes (30%) as major co-morbidities associated with CHF patients.[16]

In our study, the most common risk factors associated with the development of CHF was found to be Hypertension (57.8%), male gender (56.8%), age (47.3%), and IHD (53.6%), which is similar to risk factors revealed by the study conducted by Lawson *et al.,* where Hypertension (65%), male gender (75%), and IHD (50%) were most frequently associated risks factor.[17] similarly, Farmakis *et al.,* observed Hypertension (61.8%), male (63%) and IHD(50.7%) as most common risks factor.[18] In our study, most of the patients (59.1%) who developed CHF had 3-5 risk factors which corresponds to a south African study by Sliwa *et al.,* where 59% of the patients had several risk factors.[19] In contrast to our study, a study conducted by Dunlay *et al.,* showed that the mean number of risk factors for the development of Heart failure per case was 1.9 ±1.1.[20]

In the current study, multiple comorbidities (85.7%) are common compared to single comorbidity (11.8%), which is similar to a study conducted by Lyngkaren *et al.,* where 68% of the patients have two or more comorbidities.[21] In contrast to our study, a study conducted by Yin *et al.,* shows that single comorbidity is predominant in younger age groups (18-39 years), and multiple comorbidities were predominant in those above 80 years of age.[22]

Table 2: Risk factors among congestive heart failure patients.

Modifiable risk factors	Number of patients (%)
Hypertension	127(57.8%)
Ischemic Heart Disease	118(53.6%)
Diabetes	76(34.5%)
Cardiomyopathy	39(17.7%)
High cholesterol	33(15.0%)
Tobacco	32(14.6%)
Certain medications*	31(14.1%)
Valvular heart disease	26(11.8%)
Alcohol consumption	23(10.5%)
Irregular heart beats	15(6.8%)
Obesity	7(3.2%)
Sleep apnea	6(2.7%)
Prolonged stress	4(1.8%)
Depression	3(1.4%)
Rheumatoid arthritis	2(0.9%)
Physical inactivity	-
Birth control pill	-
Non-modifiable risk factors	
Age	104(47.3%)
Being male	125(56.8%)
Family history	5(2.3%)
Congenital heart disease	7(3.2%)
MI	3(1.4%)
Number of risk factors	
No risk factor	7(3.2%)
1-2 risk factors	49(22.3%)
3-5 risk factors	130(59.1%)
>5 risk factors	31(14.1%)

*Certain medications- NSAIDS, rosiglitazone, pioglitazone, halothane, isoflurane, ketamine, flecanide, disopyramide, doxazosin, itraconazole, doxorubicin, daunorubicin, ifosfamide, inter-leukin-2 etc

Table 3: Class of drugs prescribed.

Class of drugs	Number of patients (%)
Cardiovascular agents	212(97.69%)
Antiplatelet agents	134(61.75%)
Statins	109(50.23%)
Bronchodilators	111(51.15%)
Anticoagulants	47(21.65%)
Hypoglycemic agents	73(33.64%)
Corticosteroids	68(31.33%)
Antibiotics	124(57.14%)
Analgesic/antipyretic	44(20.27%)
GI agents	180(82.94%)
Psychotropic agents	26(11.98%)
Vitamin and nutritional supplements	114(52.53%)
Iron supplements	11(5.06%)

ACEI- angiotensin converting enzyme inhibitors, ARB- angiotensin receptor blockers, ARNI- angiotensin receptor neprilysin inhibitors, CCB- calcium channel blocker

Table 4: Most commonly prescribed HF medications.

Drugs	Individual drugs	No of patients (%)
Diuretics	Furosemide	117 (53.7%)
	Spironolactone	44(20.2%)
	Epelerenone	4(1.8%)
	Torsemide+Spironolactone	15(6.9%)
	Torsemide	85(39.0%)
Beta blockers	Metoprolol	28(12.8%)
	Propranolol	4(1.8%)
	Atenolol	1(0.5%)
	Bisprolol	2(0.9%)
	Carvedilol	17(7.8%)
ACEI	Ramipril	50(22.9%)
	Enalapril	6(2.8%)
ARNI	Sacubitril+Valsartan	7(3.2%)
ARBs	Losartan	8(3.7%)
	Telmisartan	8(3.7%)
CCBs	Amlodipine	18(8.3%)
	Cilnidipine	19(8.7%)
	Diltiazem	8(3.7%)
Alpha blockers	Prazosin	4(1.8%)
Antiarrhythmic Agents	Amiodarone	10(4.6%)
	Digoxin	38(17.4%)
Nitrates	Isosorbide mononitrate	21(9.6%)
	Isosorbide dinitrate	8(3.6%)
Anticoagulants	Warfarin	8(3.7%)
	Heparin	25(11.0%)
	Enoxaparin	9(4.1%)
	Acenocoumarol	10(4.6%)
	Dabigatran	1(0.5%)
Statins	Atorvastatin	34(15.6%)
	Rosuvastatin	4(1.8%)
	Aspirin+atorvastatin	50(22.9%)
	Aspirin+Atorvastatin+Clopidogrel	26(11.9%)
	Rosuvastatin+Aspirin+Clopidogrel	1(0.5%)
Anti-Platelet drugs	Aspirin	54(24.8%)
	Clopidogrel	45(20.6%)
	Aspirin+atorvastatin	50(22.9%)
	Aspirin+atorvastatin+clopidogrel	26(11.9%)
	Rosuvastatin+Aspirin+Clopidogrel	1(0.5%)
Bronchodilators	Ipratropium bromide + levosalbutamol	(25.34%)
	Budesonide	(24.4%)

*ACEI: Angiotensin-converting enzyme inhibitor, ARNI: Angiotensin receptor-neprilysin inhibitors, ARBs: Alpha receptor blockers, CCBs: Calcium channel blockers

In the current study, the most commonly prescribed drug was found to be Furosemide (Diuretic) (53.7%), followed by Torsemide (Diuretic) (39%), and then Aspirin (Antiplatelet) (24.8%). This is in parallel to a study conducted by Ghimire *et al.*, where Furosemide (Diuretic) was the most commonly prescribed drug followed by Spironolactone (Diuretic) and Aspirin (Antiplatelet), similarly their study and our study isosorbide dinitrate (Nitrates) prescribed was 2% and 4% respectively.[23] In contrast

to our study, a study conducted by Rao *et al.,* showed that Spironolactone (Diuretic) was most the most commonly prescribed drug, followed by Furosemide (Diuretic) and then Ramipril (ACEI). Aspirin was given only to 4% of patients in this study.[24] In our study, the most commonly prescribed class of drugs is cardiovascular agents (97.69%), which include anti-hypertensive drugs, diuretics, anti-arrhythmic drugs, anti- anginal and ionotropic agents. A study conducted by Berliner *et al.,* shows that various cardiovascular agents are of primary importance and are included in the conventional treatment of Heart failure.[25] It is also similar to another study conducted by Stewart *et al.,* where various cardiovascular agents and aspirin were the only drugs given in the treatment of Heart failure.[26]

The next most prescribed drugs are beta blockers (propranolol – 28%) in the present study, but a study by Kim *et al,.* suggests clinician should consider prescribing ACEI and/or ARBs in patients with HFpEF and HFmrEF prior to beta blockers.[27] Another class of drug is calcium channel blocker is prescribed as vasodilating agent, however it has negative inotropic effect, they might worsen the condition of patients.[28] Further, Sure *et al.,* observed only 2% of the study population was prescribed with prazosin (alpha blocker) whereas in our study it was prescribed to 1.8% of patients indicating it as less frequently prescribed drug.[29] A European study by Muntwyler *et al.,* found the use of oral anticoagulants has declined in advancing age, well in our study 21.65% of patient have received anticoagulant therapy.[30] To normalize the lipid disbalance in heart failure, 69.5% patient were prescribed with statins in a study conducted by Foody *et al.,* which is slightly more than our study (50.23%).[31] Further the Bronchodilators were prescribed in the present study correlates with the study by Crawford where bronchodilators were used to reduce the exacerbations.[32,33]

CONCLUSION

The prescribing pattern study of drugs used in the management of CHF patients shows that cardiovascular agents are the most commonly prescribed class of medications, among which diuretics account for the highest percentage. Among the diuretics, furosemide was the most commonly used. The other frequently prescribed medications included torsemide, aspirin, aspirin-atorvastatin combination, spironolactone and clopidogrel. The risk factor analysis shows that most patients had multiple risk factors, among which hypertension, male, ischemic heart disease, and age are the most common ones. Better understanding of the risk factor and prescribing aids in improved patients care.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

ACEI: Angiotensin Converting Enzyme Inhibitor; **CCF:** Congestive Cardiac Failure; **CHD:** Chronic Heart Disease; **CHF:** Congestive Heart Failure; **CVD:** Cardiovascular Disease; **HF:** Heart Failure; **HTN:** Hypertension; **IEC:** Institutional Ethics Committee; **IHD:** Ischaemic Heart Disease; **LDL:** Low Density Lipoprotein; **RHD:** Rheumatic Heart Disease; **QoL:** Quality of Life.

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