Etiological spectrum of Heart Failure in a tertiary health care facility of Central Nepal

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Background and Aims: High-income countries have reported common causes of heart failure as ischaemic heart diseases, hypertension, valvular heart diseases, and cardiomyopathies. There are limited data available about epidemiology of heart failure in low-income countries like Nepal. The main objective of this study is to explore etiological spectrum of heart failure in Nepal.

Methods: This cross-sectional study was conducted at the cardiology department of Kathmandu Medical College from April 15, 2019, to July 15, 2019. Data were collected from patients diagnosed as heart failure following the European Society of Cardiology criteria and having left ventricular ejection fraction less than 50% and classified into Heart failure with mid-range or reduced ejection fraction. Diastolic heart failure, Cor-pulmonale, and stroke were excluded. The data were entered and analyzed in Statistical Package for Social Sciences 20.0 using descriptive and inferential statistics.

Results: Among 132 heart failure patients (mean age: 63.9±13.9 years), around two-thirds (65.2%) had heart failure with reduced ejection fraction (ejection fraction of less than 40%) and one third (34.8%) had heart failure with mid-range ejection fraction (40 to 49%). Dilated cardiomyopathy was the leading cause of heart failure among nearly half (47.7%) of study participants, followed by valvular heart disease (19.7%), hypertensive heart disease (14.4%) and ischaemic heart disease (13.6%). Almost half of the study participants with dilated cardiomyopathy had severe left ventricular systolic dysfunction. (p<0.05).

Conclusion: Dilated cardiomyopathy was the most prevalent cause of heart failure, followed by valvular heart disease in our study.

Keywords: Dilated Cardiomyopathy, Etiology, Heart Failure.

Introduction
Heart Failure (HF) is emerging as a global epidemic with the prevalence of 1-2% in the adult population, rising to ≥10% after the age of more than 70 years. One year mortality rates for hospitalized and ambulatory HF patients are 17% and 7%, and hospitalization rates are 44% and 32%, respectively. It leads to high economic burden, which has greater impact in low and middle-income countries (LMICs) due to limited resources to manage such conditions.

Heart failure can be classified as having reduced, mid-range, and preserved ejection fraction. Common etiologies are ischemic cardiomyopathy, hypertensive heart disease, idiopathic cardiomyopathy and valvular heart disease in high-income countries. Nepal has high burden of rheumatic heart disease, with
prevalence in central Nepal as 0.9 per 1000. However, after including borderline and definite rheumatic heart disease in Eastern Nepal, the prevalence increases to 10.2 per 1000. Non-communicable disease risk factors like hypertension is also in increasing trend, with the current prevalence of 20%. Furthermore, low awareness, low adherence to medication, and inadequate human resources, limited healthcare infrastructure, and health disparities lead to inflation of the health challenge.

There are few studies on sociodemographic, etiologic patterns of heart failure conducted in Nepal which showed the diverse findings. Therefore, this study aims to explore the etiologic spectrum of heart failure in the tertiary level of health care of Nepal which will be valuable in better understanding the etiology for prevention and management of heart failure.

Methods
This prospective cross-sectional study was carried out at cardiology department of Kathmandu Medical College Teaching Hospital (KMCTH) for the duration of three months, from April 15, 2019, to July 15, 2019. A total of 132 participants were enrolled in the study. Patients with diastolic heart failure, cor-pulmonale, stroke, and chronic kidney disease were excluded from the study. Data were collected from the HF patients, age 18 years and above, visiting cardiology Out-patient department of KMCTH and patients admitted to cardiology ward, after completion of initial investigations and echocardiogram. The final diagnosis was made by echocardiogram with left ventricular ejection fraction less than 50%. Informed written consent was taken, and the confidentiality of participants was maintained. The HF was diagnosed according to the European Society of Cardiology criteria, namely, symptoms of HF with or without signs, with objective evidence of systolic dysfunction by echocardiography. Based on European Society of Cardiology criteria, heart failure was categorized into Heart failure with mid-range ejection fraction (HFmrEF) that includes LVEF 40 to 49% and Heart failure with reduced ejection fraction (HFrEF) which includes LVEF less than 40%. Left ventricular systolic function was also classified as per American society of echocardiography into mild (LVEF >40%), moderate (LVEF 30-40%) and severely abnormal (LVEF<30%).

Ischemic heart disease (IHD) was considered as etiology of heart failure in a patient with a documented history of myocardial infarction, unstable angina or stable angina with left ventricular dysfunction, ejection fraction (LVEF<50%). Rheumatic heart disease (RHD), was considered as a cause of HF if symptoms could be explained by lesion severity with left ventricular dysfunction, (LVEF<50%). Hypertension was considered as a cause of HF, if there was left ventricular dysfunction, ejection fraction LVEF<50% with hypertension and concentric hypertrophy. Dilated cardiomyopathy was considered the primary etiology if left ventricular systolic dysfunction was present in the absence of IHD, RHD, hypertension, and other possible causes. Congenital heart disease was considered the etiology of HF if shunt or obstructive lesion causing LV dysfunction (LVEF<50%). Asia Pacific scale was used to classify the body mass index. Ethical clearance was taken from the Institutional Review Committee of KMCTH (reference no.150420191). Data were entered and analyzed in Statistical Package for Social Sciences (SPSS) Version 20.0 using the descriptive and inferential statistics.

Results
Among the total (132) study population, 54.5% (72) were female, and 45.5% (60) were male, and two-thirds were of the age group of more than 60 years with mean age of 63.9±13.9 years. Similarly, two-thirds of the participants were obese (with body mass index ≥ 25).

Table 1: Sociodemographic Characteristics of Study Population (N=132)

| Sociodemographic Characteristics | Categories | Number (Percentage) |
|---------------------------------|------------|---------------------|
| Gender                          | Male       | 60 (45.5)           |
|                                 | Female     | 72 (54.5)           |
| Body Mass Index (kg/m²)         | <18.5      | 8 (6.1)             |
|                                 | 18.5-22.9  | 16 (12.1)           |
|                                 | 23-24.9    | 24 (18.2)           |
|                                 | ≥25        | 84 (63.6)           |
| History of Hypertension         | Yes        | 43 (32.6)           |
|                                 | No         | 89 (67.4)           |
| History of Diabetes Mellitus    | Yes        | 17 (12.9)           |
|                                 | No         | 115 (87.1)          |
| History of Smoking              | Current Smoker | 25 (18.9) |
|                                 | Ex-Smoker  | 39 (29.5)           |
|                                 | Non-Smoker | 68 (51.5)           |
| History of Alcohol Consumption  | Yes        | 30 (22.7)           |
|                                 | No         | 102 (77.3)          |

Majority of patients presented with shortness of breath (66.7%) followed by palpitation (31.8%) and swelling of lower limbs (13.6%). The mean hemoglobin concentration among the study population was 11.62 ±1.17mg/dl. Around two-thirds (65.2%) of participants had heart failure with reduced ejection fraction and remaining one third (34.8%) of patients had heart failure with mid-range ejection fraction (Table 2). Further analysis demonstrated that one-third of the study population had severe systolic dysfunction.

Regarding the cause of heart failure, dilated cardiomyopathy was the leading cause of heart failure in our study population accounting for nearly half (47.7%) of the study population followed by valvular heart disease 19.7%, and ischaemic heart disease in 13.6%. Peripartum cardiomyopathy was found among 1.5% of participants. There was one case each of mitral valve prolapse, hypertrophic cardiomyopathy and constrictive pericarditis. Among the valvular heart disease, the degenerative valvular disease was present in 12.8% and rheumatic heart disease in 6% as demonstrated in Table 2.

Comparison of the different variables with the severity of heart failure based LVEF is illustrated in Table 3. Nearly half of the study population had moderately abnormal LVEF. Similarly, nearly half of heart failure patients had hypertension, and 12.9% of them had diabetes mellitus.
the study population with dilated cardiomyopathy had severely impaired LVEF (p<0.05).

Table 2: Spectrum of Heart Failure (N=132)

| Clinical Spectrum                      | Number (Percentage) |
|----------------------------------------|---------------------|
| Major Presenting Complaints*           |                     |
| Shortness of Breath                    | 88 (66.7)           |
| Palpitation                            | 42 (31.8)           |
| Fatigue                                | 20 (15.2)           |
| Swelling of Limbs                      | 18 (13.6)           |
| Others                                 | 21 (15.9)           |
| Electrocardiogram (ECG) finding*       |                     |
| Left Bundle Branch Block               | 32 (24.2)           |
| Atrial Fibrillation                    | 27 (20.5)           |
| Sinus Tachycardia                      | 18 (13.6)           |
| Left Axis Deviation                    | 15 (11.4)           |
| Q-wave                                 | 12 (9.1)            |
| Left Ventricular Hypertrophy           | 9 (6.8)             |
| Others                                 | 29 (22.0)           |
| Heart Failure Classification           |                     |
| Heart failure with mid-range ejection fraction | 46 (34.8)   |
| Heart failure with reduced ejection fraction | 86 (65.2)   |
| Left-Ventricular Ejection Fraction     |                     |
| Mild dysfunction (>40 to 49%)          | 23 (17.4)           |
| Moderate dysfunction (30-40%)          | 65 (49.2)           |
| Severe dysfunction (<30%)              | 44 (33.3)           |
| Etiology of Heart Failure              |                     |
| Dilated Cardiomyopathy                 | 63 (47.7)           |
| Valvular Heart Disease                 | 26 (19.7)           |
| Degenerative                           | 17 (12.8)           |
| Rheumatic                              | 8 (6.0)             |
| Mitral Valve Prolapse                  | 1 (0.8)             |
| Hypertensive Heart Disease             | 19 (14.4)           |
| Ischaemic Heart Disease                | 18 (13.6)           |
| Atrial Septal Defect                   | 2 (1.5)             |
| Peripartum Cardiomyopathy              | 1 (0.8)             |
| Hypertrophic                           | 1 (0.8)             |
| Cardiomyopathy                         |                     |
| Constrictive Pericarditis              | 1 (0.8)             |

*Multiple entries were done for presenting complaints/ECG findings, a single patient presenting with multiple complaints/ECG findings.
Discussion

The global prevalence of HF is 1-2%\(^1\), with a higher prevalence among East Asian countries ranging from 1.3 to 6.7%\(^16\). The present prospective cross-sectional study has demonstrated the etiological spectrum of patients presenting with heart failure in a tertiary level of health care setting of Nepal. Among the study population, two-thirds of participants were of more than 60 years of age with a mean age of 63.9±13.9 years. A previous hospital-based study of the Eastern part of Nepal showed the mean age of HF as 53.5 years, which was lower than our study findings\(^7\). Similarly, study conducted in Pakistan and Bangladesh showed the mean age of participants with HF as 54 years and 54.1 years, respectively\(^16,19\). In contrast, the prevalence of HF is increasing in age group of above 70 years in high-income countries\(^20\). As the lifetime risk of HF increases with age, the burden of HF is likely to rise with the growing age of the population in South Asia\(^1\).

In terms of etiology of HF, one of the study reported that ischaemic heart disease has increased and valvular heart disease has decreased in the East Asia Region\(^16\). However, in our study, dilated cardiomyopathy was the significant cause of heart failure contributing for nearly half (47.7%) the patients, followed by valvular heart disease among 19.7% of cases. Ischemic heart disease accounted for 13.6% of cases. The previous study from the Western part of Nepal had reported the causes of HF as ischemic (29.5%), hypertensive (24.6%), dilated cardiomyopathy (21.6%), Cor-pulmonale (15.5%) and valvular heart disease (8.7%)\(^1\). However, Cor-pulmonale patients were excluded from our study. In contrast, a study from Central part of Nepal conducted at emergency department among the HF patients diagnosed by Framingham criteria, reported the commonest cause as rheumatic heart disease (25.1%), followed by dilated cardiomyopathy (22.8%), and coronary artery disease (18.1%)\(^22\). However, in our study outpatient and admitted patients were included and HF was diagnosed by European Society of Cardiology criteria.

Ischemic heart disease was the major cause of heart failure (35.7%), and dilated cardiomyopathy was present in 12.2% of cases in Bangladesh\(^19\). Another hospital-based study conducted in India reported rheumatic heart disease (52%) as the most common cause of heart failure followed by ischemic heart disease (17%), hypertensive heart disease (9.8%), dilated cardiomyopathy (9.8%) and congenital heart disease (5.8%)\(^23\). However, the study from Pakistan among recent-onset systolic HF with LVEF <40% reported that 77% had ischemic heart disease\(^24\). In contrast to our finding, USA National registry reported that patients with HF had a relatively higher proportion of ischemic etiology which was 52.6%, 71.1% and 72.9% for those aged <65, 65-76 and >76 years respectively\(^25\).
A study from high-income countries showed the heart failure was associated with comorbid conditions like hypertension, ischaemic heart diseases, and diabetes mellitus. Corresponding with that, our study population had hypertension and diabetes mellitus 32.6% and 12.9% respectively. A similar trend was observed in a study from Eastern Nepal with hypertension in 26.6% and diabetes in 18.7%\(^2\). However, the prevalence of a history of hypertension and diabetes in HF were found as 54.2% and 14.8% respectively in the study of Western Nepal\(^3\). Similarly, study of Bangladesh found the prevalence of hypertension and diabetes mellitus in 49.4% and 18.8% respectively\(^4\). One of the reviews from South East Asian countries reported the prevalence of coronary artery disease in 25% to 47% among HF patients. The prevalence of hypertension in HF was 23% to 47% in China. Moreover, HF due to valvular disease was reported in 15% - 35% in most countries, but only 4% in Malaysia\(^6\). Additionally, heart failure was also associated with obesity in almost two-thirds of the study population.

In our study one-third of the study population had severe systolic dysfunction and around half of the patient had moderate systolic dysfunction, resulting in a total of nearly 83% being HF with moderate to severe reduction of ejection fraction. In the study from Pakistan, 55% of patients were having severe heart failure\(^7\). There were relatively few uncommon causes such as peripartum cardiomyopathy (1.5%) and one (0.8%) each of mitral valve prolapse, hypertrophic cardiomyopathy and constrictive pericarditis in our study. The observed patterns of disease were similar to the study from India with peripartum cardiomyopathy, mitral valve prolapse, and constrictive pericarditis contributing as 1.9%, 2.8%, and 1.9% respectively\(^8\).

**Conclusion**

Dilated cardiomyopathy was the most frequent etiology of heart failure in our study, followed by valvular heart disease. Hypertensive heart disease and ischaemic heart disease were the next common causes. However, it is difficult to confirm the temporal relationship of the causal factors due to the cross-sectional nature of the study. Therefore, further analytical case-control and prospective cohort studies should be conducted to confirm the etiological factors of heart failure better. Nevertheless, our study could be helpful for better understanding and timely management of the etiology of heart failure in the context of Nepal and other similar LMICs settings.

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**References**

1. Ponikowski P, Voors AA, Anker SD, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC)Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. European heart journal. 2016;37(27):2129-200. [https://doi.org/10.1002/ehjhf.592](https://doi.org/10.1002/ehjhf.592)

2. Maggioni AP, Dahlstrom U, Filippatos G, et al. EUR Observational Research Programme: regional differences and 1-year follow-up results of the Heart Failure Pilot Survey (ESC-HF Pilot). European journal of heart failure. 2013;15(7):808-17. [https://doi.org/10.1093/eurjhf/hft050](https://doi.org/10.1093/eurjhf/hft050)

3. Cook C, Cole G, Asaria P, Jabbour R, Francis DP. The annual global economic burden of heart failure. International journal of cardiology. 2014;171(3):368-76. [https://doi.org/10.1016/j.ijcard](https://doi.org/10.1016/j.ijcard)

4. Pillai HS, Ganapathi S. Heart failure in South Asia. Current cardiology reviews. 2013;9(2):102-11. PMCID: PMC3682394

5. Ho KK, Pinsky JL, Kannel WB, Levy D. The epidemiology of heart failure: the Framingham Study. Journal of the American College of Cardiology. 1993;22(4 Suppl A):6a-13a. [https://doi.org/10.1016/0735-1075(93)90455-a](https://doi.org/10.1016/0735-1075(93)90455-a)

6. Prajapati D, Sharma D, Regmi PR, et al. Epidemiological survey of rheumatic fever, rheumatic heart disease and congenital heart disease among school children in Kathmandu valley of Nepal. Nepalese Heart Journal. 2013;10(1):1-5. DOI: [https://doi.org/10.3126/njh.v10i1.9738](https://doi.org/10.3126/njh.v10i1.9738)

7. Shrestha NR, Karki P, Mahto R, et al. Prevalence of Subclinical Rheumatic Heart Disease in Eastern Nepal: A School-Based Cross-sectional Study. JAMA cardiology. 2016;1(1):89-96. [https://doi.org/10.1001/jamacardio.2015.0292](https://doi.org/10.1001/jamacardio.2015.0292)

8. Vaidya A, Pathak RP, Pandey MR. Prevalence of hypertension in Nepalese community triples in 25 years: a repeat cross-sectional study in rural Kathmandu. Indian Heart J. 2012;64(2):128-31. [https://doi.org/10.1016/S0019-4832(12)60045-5](https://doi.org/10.1016/S0019-4832(12)60045-5)

9. Aryan KK, Mehta S, Neupane S, et al. The Burden and Determinants of Non Communicable Diseases Risk Factors in Nepal: Findings from a Nationwide STEPS Survey. PloS one. 2015;10(8):e0134834. [https://doi.org/10.1371/journal.pone.0134834](https://doi.org/10.1371/journal.pone.0134834)

10. Mehta S, Shrestha N, Mehta R, et al. Prevalence, awareness, treatment and control of hypertension in Nepal: data from nationally representative population-based cross-sectional study. Journal of hypertension. 2018;36(8):1680-8. [https://doi.org/10.1097/HJH.0000000000001745](https://doi.org/10.1097/HJH.0000000000001745)

11. Sharma D, Bkc M, Rajbhandari S, et al. Study of Prevalence, Awareness, and control of Hypertension in a Suburban Area of Kathmandu, Nepal. Indian heart journal. 2005;58(1):34-7. PMID: 18984928

12. Bhandari B, Bhuttarai M, Bhandari M, et al. Adherence to Antihypertensive Medications: Population Based Follow up in Eastern Nepal. Journal of Nepal Health Research Council. 2015;13(29):38-42. PMID: 26411711

13. Khatibzadeh S, Farzadfar F, Oliver J, et al. Worldwide risk factors for heart failure: a systematic review and pooled analysis. International journal of cardiology. 2013;168(2):1186-94. [https://doi.org/10.1016/j.ijcard.2012](https://doi.org/10.1016/j.ijcard.2012)

14. Lang RM, Badano LP, Mor-Avi V, et al. Recommendations for...
cardiac chamber quantification by echocardiography in adults: an update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. Journal of the American Society of Echocardiography: official publication of the American Society of Echocardiography. 2015;28(1):1-39.e14. https://doi.org/doi: 10.1093/ehjci/jev014

15. Lim JU, Lee JH, Kim JS, et al. Comparison of World Health Organization and Asia-Pacific body mass index classifications in COPD patients. International journal of chronic obstructive pulmonary disease. 2017;12:2465. https://doi.org/doi: 10.2147/COPD.S141295

16. Guo Y, Lip GY, Banerjee A. Heart failure in East Asia. Current cardiology reviews. 2013;9(2):112-22. PMCID: PMC3682395

17. Dhungana SP, Chaparia A, Sharma SK. Prevalence of co-morbid conditions in Heart failure: an experience at tertiary care hospital. Journal of Nobel Medical College. 2017;6(2):35-41. doi: https://doi.org/doi: 10.3126/jomnc.v6i2.19568

18. Khan Z, Khan B, Haider I, et al. Etiology of congestive heart failure at a tertiary care hospital. Rawal Medical Journal. 2010;35(2):141-4.

19. Kabiruzzaman M, Malik F, Ahmed N, et al. Burden of heart failure patients in a tertiary level cardiac hospital. Journal of Bangladesh College of Physicians and Surgeons. 2010;28(1):24-9. doi: https://doi.org/doi: 10.3329/jbcps.v28i1.4640

20. Cleland JGF, van Veldhuisen DJ, Ponikowski P. The year in cardiology 2018: heart failure. European heart journal. 2019;40(8):651-61. https://doi.org/doi: 10.1093/eurheartj/ehz010.

21. Shrestha UK, Alurkar VM, Baniya R, et al. Profiles of heart failure in the western region of Nepal: prognostic implications of the MELD-XI score. Internal Medicine Inside. 2015;3(1). doi: http://dx.doi.org/10.7243/2052-6954-3-1

22. Shareef M, KC MB, Raut R, et al. Etiology of heart failure in the emergency department of a tertiary cardiac centre of Nepal. Nepalese Heart Journal. 2017 Nov 1;14(2):1-4. doi: https://doi.org/doi:10.3126/njh.v14i2.18494

23. Chaturvedi V, Parakh N, Seth S, et al. Heart failure in India: The INDUS (INDia Ukieri Study) study. Journal of the Practice of Cardiovascular Sciences. 2016;2(1):28-35. https://doi.org/doi:10.4103/2395-5414.182988

24. Jafary FH, Kumar M, Chandna IE. Prognosis of hospitalized new-onset systolic heart failure in Indo-Asians--a lethal problem. Journal of cardiac failure. 2007;13(10):855-60. https://doi.org/doi:10.1016/j.cardfail.2007.07.005

25. Yancy CW, Fonarow GC, Albert NM, et al. Influence of patient age and sex on delivery of guideline-recommended heart failure care in the outpatient cardiology practice setting: findings from IMPROVE HF. American heart journal. 2009;157(4):754-62.e2. https://doi.org/doi: 10.1016/j.ahj.2008.12.016.