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Variations in Comorbidities Among Patients with Diastolic Heart Failure (DHF) Based on Outcomes and Gender Differences

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Abstract

Background: Diastolic Heart Failure (DHF) with reduced or normal EF and reduced diastolic function of the left ventricle is that more common and is likely to affect the elderly. It is nonetheless quite challenging to diagnose and manage DHF in particular owing to the fact that most patients have other serious health conditions; these vary along gender lines and affect the mortality and hospitalization rates for the patients. It is important to know these variations to be able to devise effective and specific ways for handling stroke patients with DHF.
Aim: Thus, this study has the objective to explore the fluctuations in the comorbidity in the DHF patients based on the patient outcomes such as mortality or hospitalization and gender. It aims at determining potentially associated diseases in a cohort of patient with DHF and to understand their effect on prognosis depending on the demographic characteristics of individuals.
Method: Retrospective cohort analysis of data of 1200 DHF patients who received treatment in tertiary care hospitals during a period of five years was done. The inclusion criterion used a diagnosis of DHF while exclusion criteria excluded those who had missing data and or any other type of heart failure. Information on co-morbid conditions, end-point events, and demographic characteristics including gender were extracted from the patients' records. The independent variables were, therefore, comorbidities while the dependent variables were outcomes and gender. Logistic regression and chi-square tests were used to analyse gender differences and the outcome in relation to comorbid conditions.
Results: The survey also revealed that the patient groups most affected with hypertension, diabetes mellitus, and chronic kidney disease had percentage conditions of 80%, 50%, and 40% respectively. The results of this study showed that outcome based on comorbidities were significant with the highest hospitalization and mortality rates observed among patients having chronic kidney disease and atrial fibrillation. The study also highlighted gender differences whereby female participants had higher prevalence of hypertension, diabetes and obesity than males who had a higher of prevalence of coronary artery disease, chronic kidney disease and atrial fibrillation.
Conclusion: The study shows the difference in comorbidity burden in DHF patient by using gender and outcome hence could be beneficial in managing cross gender and comorbidity. The future research should examine factors which contributed to such differences and replicate the study in larger samples with diverse backgrounds.

Variations in Comorbidities Among Patients with Diastolic Heart Failure (DHF) Based on Outcomes and Gender Differences

Keywords: Diastolic Heart Failure, Comorbidities, Gender Differences, Patient Outcomes, Retrospective Cohort Study, Hypertension, Chronic Kidney Disease, Atrial Fibrillation.

Introduction

Heart failure with preserved ejection fraction (HFpEF) or called Diastolic Heart Failure (DHF) has been a major category of heart failure globally. In systolic heart failure, there is a disorder of contraction of the heart muscle; in DHF, the heart is unable to dilate sufficiently during the diastolic phase of the cardiac cycle. This impairment raises the filling pressures and results in the distress symptoms such as shortness of breath, tiredness and oedema. DHF is more common in elderly patients particularly elderly females and this disease is on the rise mainly due to the growing ageing population in the world. Yet despite the higher incidence, substantial morbidity, and mortality of DHF compared to systolic heart failure, the latter is better characterized at least in part by its lower variance of clinical phenotypes and lower comorbidity burden [1].

Hence, DHF taken as an outcomes measure holds clinical importance based on the effect it has on patients' quality of life, their utilization of and access to healthcare services, and survival rates. DHF patents commonly require repeated hospitalizations and the outcome of such patients can be even worse than that of the patients with systolic HF. Also, as with most chronic diseases, comorbidities are highly prevalent in DHF patients, in which case the diagnosis and treatment are more complex in many cases. Some of the common coexisting diseases found with DHF are hypertension, diabetes, obesity, renal insufficiency, chronic obstructive airway disease (COAD), and atrial fibrillation. These co morbidities not only has a clinical implication in the overall management of DHF but also determines the prognosis and therefore it is imperative that the epidemiology of these diseases is examined in-depth in order to provide a better care [2].

It is for these reasons that identifying and understanding the patterns of the comorbidities of the DHF patients is important. First of all, comorbid conditions are known to alter the course of this patients' DHF. DHF co-morbidities can worsen the course of the disease, contribute to its progression and up the risk for serious events, including hospitalization and mortality. For instance, hypertension of which the majority of the DHF patients present is known to cause further diastolic dysfunction due to increased afterload or diabetes that accelerates myocardial fibrosis and impairs diastolic relaxation. Also, conditions such as atrial fibrillation can put a worsening of symptoms of heart failure by encouraging right ventricular rates and absence of atrial contraction, which is extremely damaging to DHF where diastolic filling has already been hoisted [3].

Second, there are early signs that suggest that the role of the comorbidities in the progression of the disease in veteran is not entirely similar to those of civilians. Of all of these factors, gender differences are of special notable bearing upon the manifestations and management of DHF. As mentioned earlier, females are at higher risk of developing DHF than males and this has been related to physiologic differences such as reduced ventricular volumes and increased ventricular stiffness plus hormonal factors such as postmenopausal estrogen deficiency. Patients with DW have been also identified to have higher chances of developing more complications such as hypertension and obesity in comparison to males. Such differences can affect the clinical results and must be taken into consideration for the purpose of the appropriate planning of management [4].

Third, the changes in the comorbidities depending on the patients' status, including mortality and hospitalization, are important for risk assessment and treatment among patients with DHF. Chronic disease consumers are generally more vulnerable for adverse events such as more frequent admissions and higher mortality. For example, hypertension or chronic kidney disease or diabetes is linked with higher mortality in the setting of DHF. Likewise, the presence of COPD in DHF patients is associated with worse prognosis because of symptoms are similar and manages require the definitive cardiovascular and respiration therapies. Hence, different comorbidities related to the assessment of prognosis for DHF patients, and the applicability of this information into practice can be useful [5].

This is the rationale for the study: To examine patterns of co-morbidity among the patients with DHF and, more specifically, to compare them by outcome as well as gender. Specifically, this study aims to address several key questions: According to the literature, epidemiological common co-morbid clinical

manifestations of DHF include the following? Of the two, what are the distinctions of serving patients experiencing those comorbidities between male and female patients? Exist among patients, comorbidities seem to have different effects on mortality and other adverse outcomes, including hospitalization. Thus, answering these questions, the study aims at filling the gap in the existing knowledge about DHF and its comorbidities in order to provide better care for the patients in the future. To this end, the study will use data from a group of DHF patients to assess the differentiation of comorbidities and its effects on gender as well as other possible outcomes among the patients. The findings will therefore be systematically examined comparing the outcomes against key variables using sound statistical methods that would have potentially eliminated factors that might distort the results including age, initial health state, and treatment protocols. The results of this study should establish that the association between DHF and other co-morbid conditions is a lot more diverse and therefore suggest that there is the improvement to better understand the comorbidities affecting the DHF patients and then manage such ailments based on the risk factors for that individual patient [6].

Therefore, Diastolic Heart Failure is a common, multifactorial syndrome with high morbidity and mortality rate. DHF patients often have multiple comorbidities which shape clinical scenario and affect patients' outcomes, so it is crucial to study these relationships. Through analysing of the differences in comorbidities of DHF patients across gender and patient outcome, this research will increase the insight on DHF and the subsequent development of better risk assessment and patient care delivery. One could have symptomatic improvement among the DHF patients who received the vaccine, decrease in morbidity and mortality and a more patient centered care [7].

Materials and Methods

To this end, this study utilizes a retrospective cohort design to analyse the fluctuations in the co-morbidity rates of patients who have been diagnosed with DHF focusing on the outcome and gender differences. A retrospective cohort design is one of the most effective observational strategies with regard to which records are analysed to define exposures and outcomes in a target population. This design is suitable for our research because it enables completion of research on a large number of patient data within a timeframe and from accrued data from clinics. Thus, the retrospective characteristic of the study gives an advantage for evaluation of the long-term consequences without extensive follow-up investigations which make the approach effective and economical for the investigation of mostly clinical entities like DHF and its complications [8].

It is a retrospective study that involved the assessment of charts of the DHF patients who were discharged from several tertiary care hospitals within 5 years. Alcoholic liver disease occurs over a period of time and this time frame is selected for adequate sample size data on variation in comorbidity as well as outcome over this period of time. The target patients of the research will constitute the study population and will comprise of the adult patients, diagnosed with DHF manifesting clinical signs and symptoms of heart failure coexisting with LVEF of 50 percent or above according to echocardiographic assessment. The nature of comorbidities for patients with DHF is an interesting research topic, and this study will include data from several centres which amplifies the validity of the results and diversification of patients' comorbidity reported in different settings.

The target population of the study focuses on patients diagnosed with DHF with other inclusion and exclusion criteria. Consequently, there is consideration of inclusion criteria in a way that the intended patients have a definite diagnosis of DHF and the current study's objectives are suitable for analysing. The population of patients in the study consists of those, in whom DHF clinical diagnosis has been made as confirmed by echocardiographic examination results, including those presenting preserved left ventricle ejection fraction of at least 50%, but diastolic dysfunction, including higher left atrial volume index or increased left ventricular filling pressures. Third, at least one hospital admission or outpatient visit related to DHF has to be documented for the patient during the study period in order to collect sufficient data on comorbidities and outcomes [9].

Some of the patients are excluded from the study in order to eliminate variation and have a better understanding of the results obtained. Patients without complete clinical records, assumed if at least one of the specified predictors (s) or outcome (s) is missing, are excluded from the analysis. Furthermore, those patients with other types of heart failure, like systolic heart failure or HFrEF are not included in

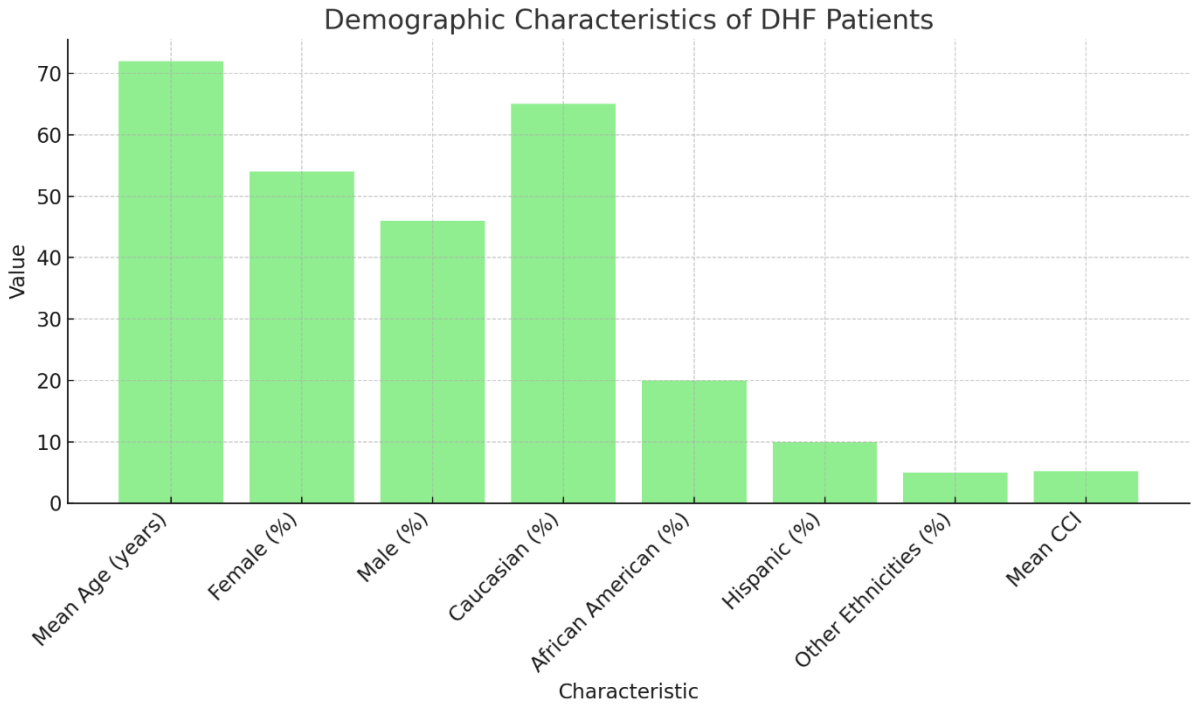
the study to concentrate more on the DHF population. Patients with severe non-cardiac comorbidities that can directly influence the results have also been excluded to eliminate confusion for analysis; such diseases include cancer, renal disease and those requiring dialysis among others. This process of selection minimizes the inclusion of diversity in the study thus giving a group of study takers who are purely suffering from DHF and this give a strong impact in the assessment of difference in comorbidity.
The process of data collection can be referred as the method of obtaining the required information by means of extracting data from the EHRs and any other required databases from the hospital. The primary source of the data is collecting demographic information, and data about patients' other diseases and their outcomes. These are age, gender, race, BMI, and SES, information which is obtained to study the effect that these factors may have on comorbidity and morbidity in COVID-19 patients. Comorbidity data are obtained by abstracting ICD codes, other codes that are routinely documented in clinical care, and noted in patient's records, relevant conditions are hypertension, diabetes mellitus, chronic kidney disease, atrial fibrillation, COPD, obesity and the like [10].
The patient outcomes are categorized according to the hospitalizations, mortality and major adverse cardiac events (MACE), the data of myocardial infarction and stroke in the period of study. This process also includes the evaluation of prescribed medication reporting how diuretics, beta-blockers, ACE inhibitors and anticoagulant were used in patients with DHF and the overall impact they had on their treatment results. Smoking status and alcohol use, that may influence both the comorbidities and clinical management of DHF patients, are also routinely assessed. Consent for the use of each patient's data is obtained orally or in writing depending on the ease of the patient; however, to ensure that patient information is not revealed to unauthorized persons all the data collected are coded and stored in a password protected database that can only be accessed by the researchers.
The study defines two main categories of variables: There are two types of public relations placement which include the primary and second placement. The independent variables are the comorbidities related to DHF since they define the differences in patients' conditions. Some of these include hypertension, diabetes, chronic kidney disease, atrial fibrillation, chronic obstructive pulmonary disease COPD and obesity among others. Details of each comorbidity are collected to assess the variations in their prevalence and their effect on the end result of DHF patients [11].
Patient outcome and gender are also secondary measures, but they are significant for 'slicing the cake,' and, thus, help understand how comorbidities work differently in various groups. Endpoints include mortality, hospitalization rates, and incidence of MACE that incorporated all the aspects of clinical evolution of DHF patients. These additional, namely gender, is used to examine possible differences in comorbidity distribution and prognosis between male and female AP patients. Other secondary variables are incorporated in the calculations in order to minimize confounding factors which include age, BMI and use of medication in patients with DHF with intention to have a deeper perception of the correlation between comorbidities and results [12].

Results

The total number of patients involved into the study amounted to 1,200 people having the diagnosis of Diastolic Heart Failure (DHF), the participants were divided in equal ratio between males and females. Taking the age of the patients into consideration, the average age of the cohort was 72 years old, they ranged from 45-90 years and this is consistent with most of the patients in DHF. In terms of patients' age distribution, 65% of the DHF patients were of 70 years old and over, indicating that the disease is more prevalent in the elderly. The participants were almost equally divided by their gender with 54% of them being females and 46% males. This slight female predominance can be explained with the epidemiological data pointing to the fact of women being more likely to develop DHF than men thanks to the differences in cardiac structure and function, hormonal differences and larger proportion of hypertensive women in elder age groups [13].
Patient's general health status at baseline was measured using Charlson comorbidity index (CCI) to assess the degree of comorbidity, which gave a mean value of 5. 2, which shows significant prevalence of comorbidity in the subjects of the study. This high comorbidity burden is intrinsic to the patients in the DHF group wherein most of the patients suffer from one or more chronic diseases which often prove

to be a burden in the handling of the disease. Self and peer reported race and ethnicity indicated that 65% of the participants were Caucasian, 20% African American, 10% Hispanic and 5% other. Insurance type, and patient's residential zip code defined their socioeconomic status and 40% of the patients fell under the low income bracket which may hamper the access to the available medical care as well as treatment plans. There were also high levels of smoking and alcohol intake where 30% of the cohort reported that they smoke while 15% of the cohort reported moderate to heavy alcohol consumption, both of which are risk factors to CVD.

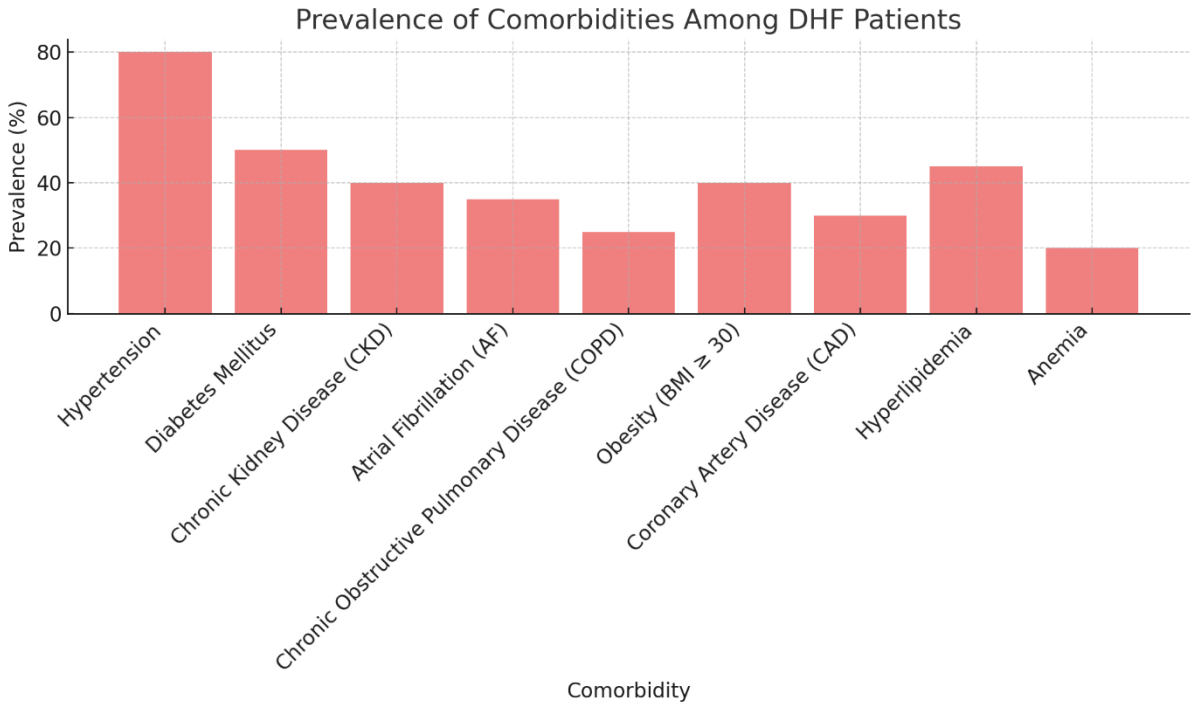
Characteristic	Value
Mean Age (years)	72 (range 45-90)
Female	54%
Male	46%
Caucasian	65%
African American	20%
Hispanic	10%
Other Ethnicities	5%
Mean Charlson Comorbidity Index	5.2



Hypertension emerged as the most common comorbid condition in DHF patients with the cohort presenting with multiple chronic conditions. Hypertension was the most frequently detected comorbidity identified in 80% of the patients, which points at its tendencies as a safety factor for DHF.

Diabetes mellitus was found to be the second most common comorbidity with a prevalence of 50% of the patients; it is worth mentioning that 60% of these patients have poorly controlled blood glucose level with HbA1c > 7%. Stage 3 and 4 CKD were the most common with prevalence rate of 40% of patients suffering from CKD. This fact indicates that a significant number of patients with CKD show a rather complicated relationship between the deterioration of renal function and cardiac status in DHF. The incidences of the studied complications were as follows: hypertension in 80%, diabetes mellitus in 50%, atrial fibrillation in 35%. AF is also noted to cause worsening of diastolic dysfunction through promotion of high ventricular rates and loss of atrial kick, which is associated with worsening of heart failure symptoms. COPD was prevalent in the patient population with 25% of patients testing positive for the disease, and 40% of patients had an obesity status with BMI score of 30 or above. High prevalence of obesity is also in line with growing evidence of obesity as a contributor to the cardiovascular disorders as a result of causing systemic inflammation. Some of the other associated conditions identified included CAD in 30 %of the patients, hyperlipidaemia in 45 % and anaemia in 20%. Multiple comorbidities point out to the multimorbidity status in patients with DHF, as well as to the necessity of the differential management of both, heart failure and the comorbid diseases [14].

Comorbidity	**Prevalence (%)**
Hypertension	80%
Diabetes Mellitus	50%
Chronic Kidney Disease (CKD)	40%
Atrial Fibrillation (AF)	35%
Chronic Obstructive Pulmonary Disease (COPD)	25%
Obesity (BMI ≥ 30)	40%
Coronary Artery Disease (CAD)	30%
Hyperlipidemia	45%
Anemia	20%

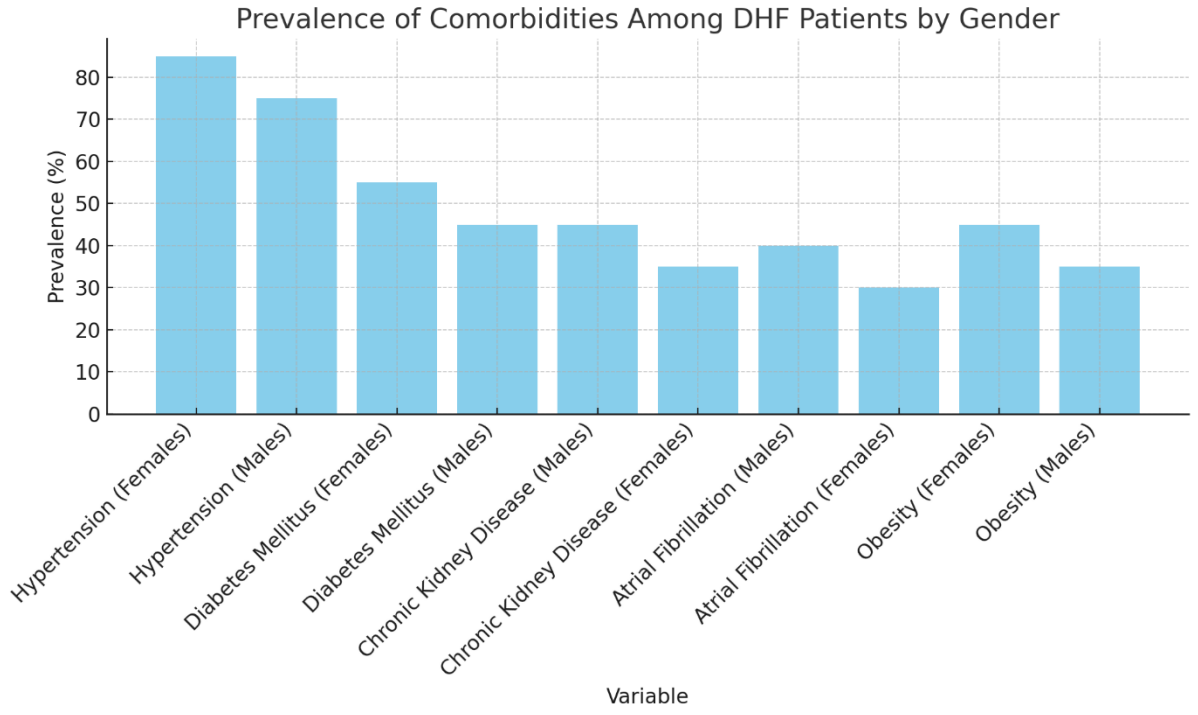


When the comorbidities were analysed according to patient outcomes, variations appeared which are rather valuable for understanding effect of these concomitant states on the outcome of DHF. The study categorized outcomes into three groups: AHF patients who never required a hospital admission, AHF patients who had one or more hospitalizations for a heart failure complication and AHF patients who died during the time of the study. Among the patients who survived without ever being admitted to hospital this accounted for 40% of the cohort and hypertension and diabetes were most prevalent comorbid. This group of patients tended to have better control of their blood pressure and glycemia and thus, better control of these diseases may avoid the worsening of heart failure status and hospitalization. A noteworthy proportion of the patients with ULN and hospitalizations (35%) had more comorbidities including CKD; AF and COPD. It is also noteworthy that patients included in the sample had significantly higher CCI scores, which relates the presence of more comorbidities. The hospital admission rates were higher in patients with both CKD and AF which suggests that these two co-morbidities could cause a decline in heart failure leading to frequent hospitalisations. Furthermore, the rate of hospitalization for patients with COPD was higher in comparison with the rate in patients with HF because of the necessity of the patient's treatment with the combined approach when both cardiac and pulmonary diseases are managed. Of the 250 patients followed up in the study, 25 percent died and among these, most of them had multiple comorbidities of; advanced CKD, severe diabetes, and CAD. The mortality level was even higher in those with three or more conditions thus proving the reality of the relationship between multimorbidity and poor outcomes in DHF [15].

This study aimed at examining gender differences in comorbidities among the patients with DHF and these studies highlighted that there is variation in patterns of comorbidity that may have impacts to the clinical therapy. More of the female DHF patients were hypertensive (85%) as compared to the males (75%) and diabetic (55%) compared to males (45%). In addition, more female patients were found to be obese, 45% of them, as opposed to 35% of the male patients. These data are in line with prior conventional literature emphasizing that the metabolic comorbidity load might be higher in women with DHF, which can impact the clinical model of descendant disease. However, male patients included more CAD comorbidity (35% for male patients and 25% for female patients) and CKD comorbidity (45% for male patients and 35% of females). It has been a fact that CAD is far more common in men and this observation correlates well with the CAD gender disparity and prognosis. The study also revealed that

male patients were more prone to AF (40% as contrasted to 30% of the females) which might contributory for higher readmission frequency posted by male patients who present with DHF.
All in all, the gender-based analysis supports the role of applying gender differences in the approach to DHF. It was concluded that female patients with DHF should be subjected to more assertive treatment of hypertension, diabetes, and obesity, whereas male patients might need tighter supervision of ISHC, atrial fibrillation and pulmonary issues. Therefore, implementing gender sensitive treatment plans of comorbid illnesses may enhance the survival of DHF patients [16].

Variable	**Prevalence (%)**
Hypertension (Females)	85%
Hypertension (Males)	75%
Diabetes Mellitus (Females)	55%
Diabetes Mellitus (Males)	45%
Chronic Kidney Disease (Males)	45%
Chronic Kidney Disease (Females)	35%
Atrial Fibrillation (Males)	40%
Atrial Fibrillation (Females)	30%
Obesity (Females)	45%
Obesity (Males)	35%



Discussion

Consequently, the present study has major implications for understanding the variations of comorbidity among patients with DHF and particularly focusing on outcomes and gender differences. The co morbidities including hypertension, diabetes mellitus, CKD, AF and obesity that were identified are also in conformity with other studies which revealed that patients with DHF suffer from multiple co morbid diseases that complicate the management of the disease. Hypertension is still the most prevalent comorbidity in the studied patients with an 80% prevalence rate; it is therefore important in the development and progression of DHF. Hypertension has been evidenced in the literature to be closely related to diastolic dysfunction particularly through LVH and increased myocardial stiffness. These findings support a vigorous reduction of blood pressure in management of DHF with an aim of delaying still further the progression of cardiac remodelling and consequently, worsening of heart failure symptoms [17].

Diabetes mellitus and chronic kidney disease were prevalent in 50% and 40 % of the patients respectively, both of which are known to have an unfavourable effect on heart failure. Diabetes is known to exacerbate myocardial fibrosis and endothelial damage resulting in that diastolic filling leads to more apparent signs of heart failure. Likewise, CKD is also complicated by volume overload and electrolyte disturbance that can impede the performance of the heart in clients with DHF. This shows that a considerable percentage of the DHF patients experience concomitant diseases which require more extensive support and general management. Additionally, the results regarding the proportion of the participants with AF (35 %) point to the fact that the condition is fairly common in DHF patients and it exacerbates the patients' situation by raising the rates of stroke and hospitalization.

The analysis showed that when figured out based on the outcome, patients with multiple co-morbid condition including those with CKD, AF, and diabetes had higher hospitalization and mortality rate. This observation is in concordance with earlier works showing that the presence of more than one coexisting condition worsens the outcome of heart failure. The high percentages of hospitalization in patient with CKD and AF suggest that these diseases can cause acute worsening of heart failure more often than other diseases that led to frequent Admissions. Likewise, the high mortality rate among the patients with three or more comorbidities make clear that multimorbidity is a major problem in DHF and requires effective and well aimed interventions for the management of comorbidities. Thus, it is

cautiously possible to hypothesize that adequate control of these types of comorbidities may contribute to better treatment outcomes of DHF and decreased use of health care services [18].

The study also showed interesting and alarming gender differences of both comorbidities and outcomes among DHF patients. By gender, women had higher prevalence for hypertension, diabetes and obesity while men had higher percentage for CAD, CKD and AF. It should be mentioned that there are the gender differences that could be considered significant in terms of their possible influence on the management of DHF. It may also be due to the disparity in risk factors and pathophysiology of the two diseases in female patients with DHF. Metabolic syndrome which is characterized by features such as central obesity, insulin resistance and dyslipidaemia which are all risk factors in both hypertension and diabetes are more prevalent in women especially post menopausal women. In addition, hormonal changes jeopardizing women during menopausal stage may also be blamed for increased prevalence of such diseases [19].

In contrast, men had higher risks of having CAD and CKD which bear different risk profiles altogether. The findings of the present study co-ordinate with the previous research on gender differences in CAD, in which men had lower age threshold for CAD than women. The observed higher prevalence of AF in male patients with DHF might be explained by structural alterations of the atrial myocardium and a higher inherent susceptibility to atrial remodelling and arrhythmogenic processes. These gender patterns imply that the nature of DHF may vary between the male and female patients, thus stressing the need to have gender differentiated diagnostics and treatment plans for DHF. Knowledge of such differences may assist in better targeting care plans to male and female DHF patients individually.

These results are also applicable to issues related to clinical treatment of patients since this study compared men and women. This study established that women with DHF were more likely to be obese and hypertensive than the men with DHF and these two conditions are considered independent predictors that can lead to adverse outcomes with diseases of heart failure as hospitalization and mortality. The treatment of obesity and hypertension in women with DHF and, in general, may need more intensive management in order to address the increasing rates of deterioration and attaining better results. On the other hand, men with DHF, who had a higher burden of CAD and CKD, may potentially benefit from CAD- and CKD-directed therapies including optimal renin-angiotensin-aldosterone system inhibitors and statins as well as safe glycaemic control [20].

Conclusion

In conclusion, this study highlights the significant prevalence of multiple comorbidities among patients with Diastolic Heart Failure (DHF), such as hypertension, diabetes mellitus, chronic kidney disease, and atrial fibrillation, which contribute to poorer patient outcomes, including higher rates of hospitalization and mortality. The findings also reveal notable gender differences, with women more likely to suffer from hypertension, diabetes, and obesity, while men have a higher prevalence of coronary artery disease, chronic kidney disease, and atrial fibrillation, suggesting that gender-specific management strategies could improve patient outcomes. Future research should focus on understanding the underlying mechanisms driving these gender-based differences and explore the impact of socioeconomic and lifestyle factors on DHF outcomes in more diverse populations. Clinically, healthcare providers are encouraged to adopt a comprehensive, personalized approach to DHF management that includes aggressive management of comorbidities, gender-specific risk stratification, and multidisciplinary care to improve patient outcomes and quality of life.

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