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Original Article

Identifying Key Factors Contributing to Acute Decompensated Heart Failure in Patients with Left Ventricular Dysfunction: A Cross-Sectional Study

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Abstract

Objectives: This study aims to identify the spectrum of factors contributing to acute decompensated heart failure (ADHF) in patients with established left ventricular dysfunction.

Methodology: We conducted a prospective cross-sectional study over six months (October 24, 2021, to April 24, 2022) at the Department of Cardiology, Medical Teaching Institute, Khyber Teaching Hospital (MTI-KTH) Peshawar. Using a non-probability consecutive sampling technique, a sample size of 100 patients was determined with the WHO sample size calculator. We evaluated factors including dietary noncompliance, medication adherence, infections, arrhythmias, acute coronary ischemia, uncontrolled hypertension, and anemia in patients with decompensated heart failure. The study included both genders, aged 30 to 80, with diabetes and hypertension but without ischemic heart disease. Data were analyzed using IBM-SPSS 23, with the Chi-square test applied for statistical analysis.

Results: Dietary noncompliance was observed in 51% of patients, while 52% adhered to their medication regimen. Contributing factors included poor attitude (16%), financial difficulties (17%), inadequate guidance (9%), and illiteracy (6%). Infections were prevalent, with pulmonary infections in 29%, urinary tract infections (UTI) in 1%, sepsis in 6%, and both UTI and sepsis in 64%. Cardiac conditions showed that 90% had no arrhythmias, 8% had atrial fibrillation (AF), and 1% each had other supraventricular tachycardia (SVT) and sustained ventricular tachycardia (VT). Acute coronary syndrome (ACS) was present in 47% of patients. The mean age was 61.6 ± 11.7 years. Only hypertension showed a significant correlation with acute decompensation.

Conclusion: The main factors contributing to ADHF were uncontrolled hypertension, dietary noncompliance, anemia, and medication nonadherence. Addressing these modifiable factors through regular monitoring could reduce ADHF incidence and improve patient outcomes.

Keywords: Acute Decompensated Heart Failure, Arrhythmias, Left Ventricular Dysfunction

INTRODUCTION

Heart failure (HF) is a chronic and progressive condition characterized by structural or functional cardiac abnormalities that lead to either decreased or preserved left ventricular ejection fraction (LVEF). Acute heart failure (AHF) is defined by new or worsening symptoms of HF and represents a major cause of unexpected hospital admissions, particularly in patients over the age of 65. Acute decompensated heart failure (ADHF) refers to a sudden worsening of previously stable chronic HF or the emergence of HF symptoms in patients with no prior history of the condition [1].

ADHF is a complex condition with an incomplete understanding of its pathophysiology and limited therapeutic options [2]. Contributing factors to ADHF include inadequate dietary management, medication nonadherence, worsening renal function, and uncontrolled hypertension. Management of ADHF focuses on addressing low cardiac output, fluid congestion, and optimizing treatment strategies [3]. Current guidelines recommend the use of loop diuretics to manage fluid overload; however, despite their use, many patients are discharged with persistent signs of volume overload, as highlighted by the Acute Decompensated Heart Failure National Registry (ADHERE) [4], which reports that 20% of patients are discharged with higher body weights [5].

In the U.S. and Europe, heart failure readmission rates are alarmingly high, with approximately 24% of patients readmitted within 30 days and 50% within 6 months [6]. These readmissions are associated with increased mortality risks; for instance, readmission within 30 days is linked to a 1 in 6 chance of death [7]. Understanding the diverse factors contributing to ADHF is crucial for improving these outcomes. Furthermore, inadequate management of ADHF often results in prolonged congestion post-discharge, which exacerbates the risk of repeat hospitalizations, increased morbidity, and mortality. This study aims to identify and analyze the various factors leading to decompensation in patients with established left ventricular dysfunction.

METHODOLOGY

Study Design: This research was designed as a cross-sectional study conducted over a six-month period, from October 24, 2021, to April 24, 2022. The study

aimed to assess various factors contributing to the decompensation of heart failure among patients admitted to a tertiary care unit.

Setting: The study was carried out at the Department of Cardiology, MTI-KTH Peshawar, a tertiary care facility renowned for its specialized cardiology services. The setting provided an appropriate environment for evaluating patients with left ventricular failure, given its comprehensive diagnostic and therapeutic capabilities.

Participants: The study included patients aged 30 to 80 years, regardless of gender, who had a history of diabetes and hypertension and were experiencing decompensated heart failure. Patients with ischemic heart disease were excluded from the study. Exclusion criteria also encompassed individuals with dementia or other mental disorders, chronic kidney disease, liver disease, and those requiring mechanical ventilation or intubation. A non-probability consecutive sampling technique was employed to select participants who met the inclusion criteria and were admitted during the study period.

Variables: The study aimed to evaluate various dependent variables, including noncompliance with diet, lack of adherence to prescribed medications, infections, arrhythmias, acute coronary ischemia, uncontrolled hypertension, and anemia. Independent variables assessed included age, gender, and the duration of left ventricular failure.

Data Sources/Measurement: Baseline demographic data, including age, gender, and duration of left ventricular failure, were recorded upon patient presentation. Comprehensive history and physical examinations were conducted. Relevant investigations were performed to identify the presence of ischemia, arrhythmias, infections, and other disorders such as anemia. Data were collected through medical records and diagnostic tests.

Bias: To minimize bias, the study employed a non-probability consecutive sampling technique, ensuring that all eligible patients admitted during the study period were considered. Exclusion criteria were clearly defined to avoid confounding factors that might affect the study outcomes.

Ethics: The study protocol was reviewed and approved by the Ethical Review Board (IRB) under Reference number 965/DME/KMC, dated 01-10-2021, ensuring ethical standards were maintained.

Study Size: The sample size of 100 participants was determined using the WHO sample size program, with a confidence interval of 95%, a margin of error of 7%, and an estimated prevalence of 15% for decompensated heart failure [8].

Quantitative Variables: Quantitative data were expressed as mean ± standard deviation (SD). This included variables such as age and duration of left ventricular failure.

Statistical Methods: Statistical analysis was performed using IBM-SPSS version 23. Descriptive statistics, including mean and standard deviation, were used for quantitative variables. Frequency and percentage calculations were employed for qualitative factors. Post-stratification chi-square tests were used to analyze the relationship between categorical variables, with a significance threshold set at a p-value of less than 0.05.

RESULTS

Participants: The study included 100 patients admitted to the Department of Cardiology, MTI-KTH Peshawar, with a diagnosis of acute decompensated heart failure (ADHF). The participants ranged in age from 30 to 80 years, with a mean age of 61.66 ± 11.709 years. The duration of left ventricular dysfunction among the participants was 3.485 ± 3.3773 years. Of the participants, 46% were aged over 60 years, while 54% were aged 60 years or younger. Gender distribution showed that 52% of the participants were female and 48% were male.

Descriptive Data: The study population consisted of 100 patients with acute decompensated heart failure. The mean age of the participants was 61.66 years with a standard deviation of 11.709 years, and the average duration of left ventricular dysfunction was 3.485 years, with a standard deviation of 3.3773 years. Among the participants, 46% were aged over 60 years, while 54% were aged 60 years or younger. The gender distribution was relatively balanced, with 52% female and 48% male patients. Dietary noncompliance was observed in 51% of the patients,

with contributing factors including poor attitude (16%), financial difficulties (17%), inadequate guidance (9%), and illiteracy (6%). In terms of medication adherence, 52% of the patients maintained regular compliance with their prescribed medications. The distribution of co-morbidities among the patients was diverse, with infections being the most common, followed by arrhythmias, acute coronary syndrome, uncontrolled hypertension, and anemia.

Table 1: Distribution of different co-morbidities and their sub-types in the study population

Co-morbidities	Frequency (%)
Infection	
Pulmonary Infection	29 (29%)
UTI and Sepsis	64 (64%)
UTI	1 (1%)
Sepsis	6 (6%)
Arrhythmias	
Atrial Fibrillation	8 (8%)
Other SVT	1 (1%)
Sustained VT	1 (1%)
ACS	
Unstable Angina	32 (32%)
NSTEMI	11 (11%)
STEMI	4 (4%)
Uncontrolled Hypertension	68 (68%)
Anemia	35 (35%)

UTI-Urinary Tract Infection, SVT-Supra ventricular tachycardia, VT-Ventricular Tachycardia, ACS-Acute coronary Syndrome

Outcome Data: The comparison of different study parameters across various factors revealed several key insights. When comparing age groups, dietary noncompliance was slightly higher in patients aged 60 years or younger compared to those older than 60 years, though the difference was not statistically significant (p=0.165).

Table 2: Comparison of age groups with different study parameters

Condition	Age Groups		P-Value
	≤ 60 Years	> 60 Years	
Noncompliance with diet			
Yes	31	20	0.165
No	23	26	
Noncompliance with medications			
No	25	27	0.367
Poor Attitude	12	4	
Financial reasons	8	9	
Poor Guidance	5	4	
Uneducated	4	2	
Infections			
Pulmonary Infection	14	15	0.557
UTI and Sepsis	36	28	
UTI	0	1	
Sepsis	4	2	

Similarly, medication noncompliance was also comparable between the two age groups (p=0.367). Infections, including pulmonary infections, urinary tract infections, and sepsis, were observed across both age groups without significant variation (p=0.557). Gender-based analysis showed that dietary noncompliance was more prevalent among female patients, although the difference was not statistically significant (p=0.73). Medication noncompliance and arrhythmias were also comparable between genders, but uncontrolled hypertension was significantly more common in female patients (p=0.016). Finally, the duration of left ventricular dysfunction was not significantly associated with medication noncompliance or arrhythmias, though there was a trend towards a higher prevalence of uncontrolled hypertension in patients with a shorter duration of left ventricular dysfunction (p=0.092).

Table 3: Comparison of Genders with different study parameters

Condition	Gender		P-Value
	Male	Female	
Noncompliance with diet			
Yes	20	31	0.73
No	28	21	
Noncompliance with medications			
No	29	23	0.349
Poor Attitude	7	9	
Financial reasons	5	12	
Poor Guidance	5	4	
Uneducated	2	4	
Arrhythmias			
No	44	46	0.496
Atrial Fibrillation	3	5	
Other SVT	0	1	
Sustained VT	1	0	
Uncontrolled HTN			
Yes	27	41	0.016
No	21	11	

SVT-Supra ventricular tachycardia, VT-Ventricular Tachycardia, HTN-Hypertension

Main Results: The study revealed that dietary noncompliance was prevalent in over half of the patients, while medication adherence was relatively higher. The distribution of co-morbidities highlighted a significant presence of infections, arrhythmias, and uncontrolled hypertension. Analysis of the data showed no significant differences in most parameters across age groups and gender, except for uncontrolled hypertension, which was more common in female patients. The duration of left ventricular

dysfunction did not significantly affect medication compliance or arrhythmias, though it had a tendency to influence uncontrolled hypertension.

Table 1: Comparison of duration of LV Dysfunction with different study parameters

Condition	Duration of LV Dysfunction		P-Value
	< 5 Years	> 5 Years	
Noncompliance with medications			
No	41	10	0.501
Poor Attitude	11	5	
Financial reasons	14	3	
Poor Guidance	8	1	
Uneducated	6	0	
Arrhythmias			
No	72	18	0.862
Atrial Fibrillation	7	1	
Other SVT	1	0	
Sustained VT	1	0	
Uncontrolled HTN			
Yes	52	16	0.092
No	29	3	
Infections			
Pulmonary Infection	20	9	0.262
UTI and Sepsis	55	9	
UTI	1	0	
Sepsis	5	1	
ACS			
No	42	11	0.59
Unstable Angina	25	7	
NSTEMI	10	1	
STEMI	4	0	

UTI-Urinary Tract Infections, SVT-Supra ventricular tachycardia, VT-Ventricular Tachycardia, HTN-Hypertension, ACS-Acute coronary Syndrome

DISCUSSION

Despite recent advancements in heart failure management, the frequency of hospitalizations related to congestive heart failure (CHF) continues to rise, particularly among individuals aged 65 years and older [9]. In our study, the mean age of participants was 61.66 ± 11.709 years, and the average duration of left ventricular (LV) dysfunction was 3.485 ± 3.3773 years. Acute heart failure hospitalizations can be attributed to several factors, including infections, arrhythmias, myocardial ischemia, and uncontrolled hypertension [10].

Our findings reveal that 52% of patients exhibited noncompliance with dietary recommendations, a factor that aligns with previous studies indicating that dietary nonadherence is a significant contributor to heart failure exacerbations [11]. For instance, Diaz et al. reported that 30% of patients did not adhere to their prescribed medication regimen, while a

Pakistani study noted a 20.3% rate of medication noncompliance [12]. In our sample, the frequency of noncompliance was notably high, with dietary noncompliance being a prevalent issue.

Our study also corroborates findings from a Polish study, which identified a correlation between various clinical markers (such as renal impairment, diuretic use, Brain Natriuretic Peptide (BNP) levels, anemia, and cardiac chamber sizes) and the risk of heart failure decompensation [13]. Specifically, we observed a high prevalence of hypertension (68%), anemia (35%), and infections (pulmonary infections at 29% and urinary tract infections with sepsis at 64%) among our participants. These findings underscore the importance of managing comorbid conditions to mitigate the risk of acute heart failure exacerbations.

In terms of age and gender, our analysis did not reveal significant correlations with most study parameters, except for hypertension, which showed a significant association with heart failure decompensation (p-value of 0.016). This finding is consistent with a study by Shah et al., which reported a similar significant correlation (p-value of 0.028) between hypertension and heart failure exacerbation. However, a U.S.-based study reported consistent relationships across various age groups and conditions, including coronary artery disease, hypertension, pulmonary impairment, renal failure, and atrial fibrillation [14].

The duration of LV dysfunction and various comorbidities did not show a significant correlation with acute decompensation in our study. This lack of significant findings could be attributed to the relatively small sample size and the single-center design of the study. Larger, multi-center studies may provide more robust data on these relationships.

Despite the availability of guidelines-directed medical therapies and a growing array of medications for chronic heart failure, the management of acute decompensated heart failure (ADHF) remains challenging. The complex and often poorly understood mechanisms underlying ADHF contribute to its management difficulties. Effective treatment of ADHF is crucial as it is associated with poorer prognoses and an increased risk of multi-organ failure and repeated hospitalizations [15].

Limitations

This study's limitations include its single-center design and relatively small sample size, which may affect the generalizability of the findings. The focus on a specific patient population at one institution may not fully represent the broader community. Additionally, the cross-sectional nature of the study limits the ability to establish causal relationships between the identified factors and acute decompensation. Future research with larger, multi-center cohorts and longitudinal designs could provide more comprehensive insights and enhance the applicability of the results to diverse populations.

CONCLUSION

This study identified uncontrolled hypertension as the most prevalent factor associated with acute decompensated heart failure (ADHF) in our community, with dietary noncompliance, anemia, and medication nonadherence also being significant contributors. Many of these factors are modifiable and could potentially be managed more effectively with regular and comprehensive monitoring. By addressing these issues proactively, we can reduce the incidence of ADHF and minimize the risk of re-hospitalization, ultimately alleviating the burden on both patients and the healthcare system.

AUTHORS' CONTRIBUTION

MF, Y, ZU, LK, SJ, and MKK: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. MF, Y, ZU, LK, SJ, and MKK: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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