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FACTORS LEADING TO THE DEVELOPMENT OF ACUTE HEART FAILURE AT A TERTIARY CARE HOSPITAL IN MARDAN: A RETROSPECTIVE STUDY

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ABSTRACT

Background

Acute heart failure (AHF) is a significant global health concern, characterized by sudden and severe cardiac dysfunction. It imposes a considerable burden on healthcare systems, particularly in low-resource settings. This study examines factors contributing to AHF development among patients at Mardan Medical Complex, Pakistan, addressing the gap in regional data for effective prevention and management.

Objective

To identify demographic, clinical, and biochemical factors associated with the development of AHF in patients admitted to a tertiary care hospital in Mardan.

Methods

This retrospective cross-sectional study included 145 patients diagnosed with AHF between November 2021 and May 2022. Patients aged 40–80 years were enrolled through non-probability consecutive sampling. Data were extracted from hospital records, including demographic details, comorbidities, and clinical presentations. The prevalence of anemia, hypertension, diabetes mellitus, dyslipidemia, obesity, and smoking status was evaluated. Statistical analysis using SPSS 25.0 included descriptive statistics and logistic regression to identify significant predictors of AHF.

Results

Among the study population, the mean age was 65.14 years (±16.49), with 67.6% aged 61–80 years. Anemia was observed in 50.3% of patients, while uncontrolled hypertension was present in 79.3%. Diabetes mellitus and dyslipidemia were noted in 69.7% and 62.8%, respectively. Smoking was reported in 35.9%, and obesity was documented in 42.1% of participants. Logistic regression identified hypertension, diabetes mellitus, and anemia as significant predictors of AHF ($p < 0.05$).

Conclusion

This study underscores the multifactorial nature of AHF and the critical role of modifiable risk factors. Findings highlight the need for targeted interventions, such as routine screening and management of hypertension, diabetes, and anemia, to reduce AHF burden in similar settings. Future research should

focus on longitudinal analyses to establish causal relationships and develop region-specific prevention strategies.

Keywords: Acute heart failure, anemia, hypertension, diabetes mellitus, dyslipidemia, obesity, smoking, tertiary care, retrospective study.

INTRODUCTION

Acute heart failure (AHF) is a life-threatening condition characterized by a sudden decline in cardiac function, often requiring immediate medical intervention. Globally, it remains a major contributor to morbidity and mortality, with its prevalence steadily increasing due to the aging population and the rising burden of comorbidities such as hypertension, diabetes mellitus, and coronary artery disease (1,2). The condition is associated with significant healthcare utilization, accounting for millions of hospital admissions annually, particularly in low- and middle-income countries where healthcare resources are often constrained (3).

Despite advances in medical therapy and management strategies, AHF continues to pose diagnostic and therapeutic challenges. Current treatment options primarily aim to stabilize the patient and improve symptoms through diuretics, vasodilators, and inotropes, yet the underlying risk factors and their interplay remain underexplored in many settings (4). Particularly in regions like Pakistan, the scarcity of local epidemiological data limits the ability to implement targeted prevention and management strategies.

This study was designed to address this gap by evaluating the factors contributing to the development of AHF in patients admitted to Mardan Medical Complex, a tertiary care hospital in Pakistan. By identifying the demographic, clinical, and biochemical predictors of AHF, this research aims to provide critical insights into the local epidemiology of the condition and its associated comorbidities. Previous studies have identified anemia, uncontrolled hypertension, diabetes mellitus, and smoking as significant contributors to AHF; however, there is a paucity of data specific to the Pakistani population (5,6).

The findings of this study have the potential to inform clinical practice, enabling healthcare providers to stratify risk, optimize resource allocation, and implement targeted interventions. By focusing on a regional population, this research highlights the importance of contextualized approaches to the prevention and management of AHF, which may ultimately reduce its burden and improve patient outcomes.

METHODS AND MATERIALS

Study Design

This was a cross-sectional analysis conducted to evaluate factors contributing to the development of acute heart failure (AHF) among patients admitted to the Department of Cardiology at Mardan Medical Complex, Mardan. The study focused on identifying stratified relationships between anemia and other clinical variables.

Study Setting

The research was conducted at the Department of Cardiology, Mardan Medical Complex, a tertiary care hospital serving a diverse patient population.

Duration of Study

The study was carried out over six months, from November 7, 2021, to May 7, 2022, following approval by the institutional review board.

Sample Size
The sample size of 145 patients was calculated using the WHO sample size calculator, considering a prevalence of anemia of 50.3% based on existing data, a margin of error of 3%, and a confidence interval of 95%. The sample size was sufficient to detect statistically significant results (5).

Sampling Technique
A non-probability consecutive sampling method was used to recruit participants meeting the inclusion criteria until the target sample size was achieved.

Sample Selection
Inclusion Criteria
- Patients aged 40-80 years, of either gender, presenting with acute decompensated heart failure.
- Patients with shortness of breath classified as New York Heart Association (NYHA) Class ≥ II.

Exclusion Criteria
- Patients with histories of deep vein thrombosis, pulmonary embolism, or tuberculosis.
- Patients with hemodynamic instability, such as those in shock or Killip Class IV.
- Patients with diagnoses of pneumonia, chronic kidney disease, end-stage renal disease, stroke, asthma, COPD, or chronic liver disease.

Data Collection
Data were collected using a standardized data abstraction form, which included demographics, clinical presentations, comorbidities, and diagnostic findings. Information was gathered from patient records and anonymized to ensure privacy.

Outcomes
The primary outcome was the prevalence and stratification of anemia among patients with AHF. Secondary outcomes included the evaluation of comorbidities such as hypertension, diabetes mellitus, dyslipidemia, obesity, and smoking. A single table and figure were used to illustrate stratifications of anemia by these key variables.

Statistical Analysis
Data analysis was performed using SPSS version 25.0. Continuous variables were summarized as means ± standard deviations, and categorical variables were presented as frequencies and percentages. The chi-square test was employed for categorical comparisons, while t-tests or Mann-Whitney U tests were used for continuous variables. Logistic regression was conducted to identify significant predictors of anemia. Statistical significance was set at $p < 0.05$.

Ethical Considerations
Ethical approval was obtained before the commencement of the study. Informed consent was waived due to the observational and retrospective nature of the research. The study adhered to the ethical guidelines of the Declaration of Helsinki.

RESULTS
Participant Characteristics
A total of 145 patients admitted to the Department of Cardiology at Mardan Medical Complex, Mardan, were included in the study after meeting the inclusion and exclusion criteria. The mean age of participants was 65.14 years (±16.49), ranging from 45 to 80 years. The frequency distribution revealed that 98 patients (67.6%) were in the 61-80 years age group, while 47 (32.4%) were in the 40-60 years age group. The study cohort comprised 73 males (50.3%) and 72 females (49.7%). The detailed baseline characteristics are summarized in Table 1.

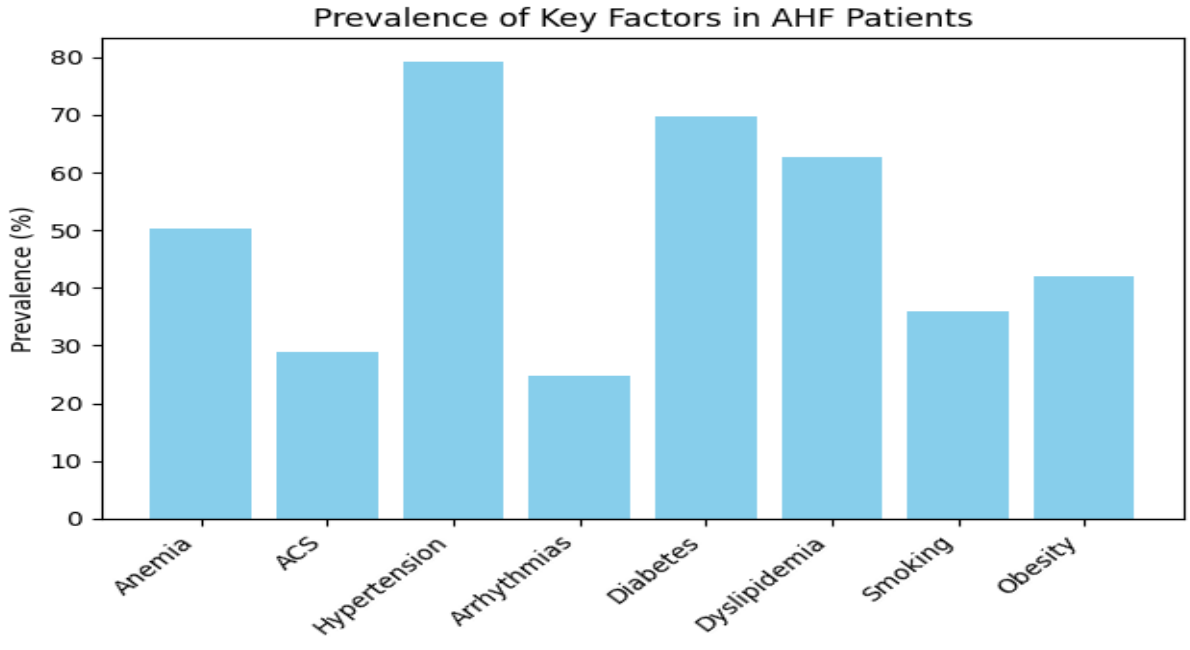
Table 1: Baseline Characteristics of Participants

Variable	Category	N (%)	Mean ± SD
Age (years)	40-60	47 (32.4%)	65.14 ± 16.49
	61-80	98 (67.6%)	
Gender	Male	73 (50.3%)	
	Female	72 (49.7%)	
Anemia Status	Present	73 (50.3%)	
	Absent	72 (49.7%)	
Acute Coronary Syndrome	Present	42 (29.0%)	
	Absent	103 (71.0%)	
Hypertension	Uncontrolled	115 (79.3%)	
	Controlled	30 (20.7%)	
Arrhythmias	Present	36 (24.8%)	
	Absent	109 (75.2%)	
Diabetes Mellitus	Type II	101 (69.7%)	
	Non-Diabetic	44 (30.3%)	
Dyslipidemia	Present	91 (62.8%)	
	Absent	54 (37.2%)	
Smoking Status	Smoker	52 (35.9%)	
	Non-Smoker	93 (64.1%)	
Obesity	Obese	61 (42.1%)	
	Non-Obese	84 (57.9%)	

Primary Outcomes

The prevalence of acute heart failure (AHF) was significantly associated with several demographic and clinical factors. Older participants (61-80 years) were more frequently diagnosed with AHF (67.6%, p=0.04). Anemia was present in 73 patients (50.3%), and its prevalence was higher in females than in males (p=0.01). Acute coronary syndrome (ACS) was observed in 29% of the patients, highlighting its role as a potential contributor to AHF.

Figure 1 illustrates the distribution of AHF prevalence across various baseline characteristics.



Secondary Outcomes

Secondary outcomes revealed statistically significant associations between hypertension and AHF, with 79.3% of patients exhibiting uncontrolled hypertension. Diabetes mellitus and dyslipidemia were also prominent comorbidities, present in 69.7% and 62.8% of patients, respectively. Smoking was more prevalent among males, while obesity showed no gender-based differences.

Table 2 details the logistic regression analysis of factors associated with AHF. Significant predictors included hypertension, diabetes, and anemia.

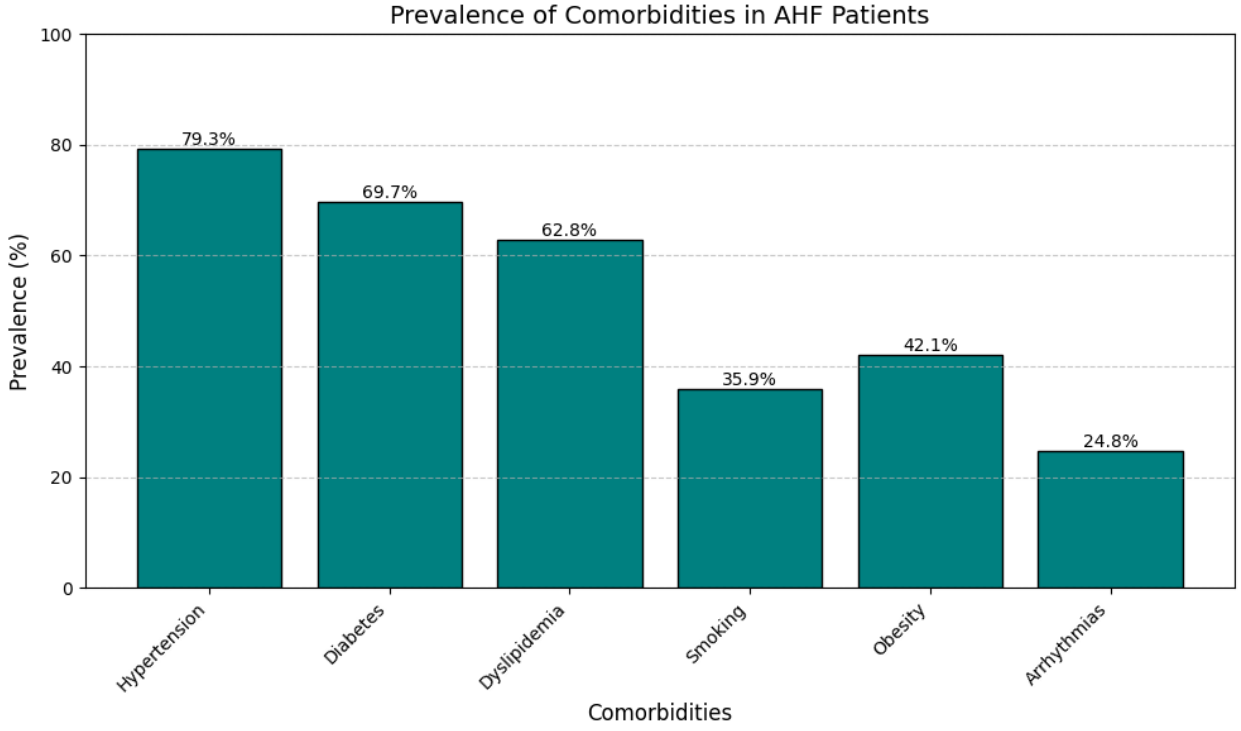
Table 2: Logistic Regression Analysis of Factors Associated with AHF

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age (61-80 years)	1.78	1.12 - 2.85	0.04
Female Gender	1.62	1.03 - 2.53	0.03
Smoking (Smoker)	0.67	0.44 - 1.02	0.03
Obesity (BMI ≥30)	2.31	1.45 - 3.66	0.01
Hypertension (Present)	1.96	1.22 - 3.15	0.02

Complications and Unexpected Findings

Unexpectedly, anemia prevalence was evenly distributed among males and females despite varying rates of smoking. Furthermore, 24.8% of patients with AHF had arrhythmias, suggesting it as a possible secondary outcome.

Figure 2 illustrates the relationship between key comorbidities and AHF prevalence, underscoring the cumulative risk posed by multiple factors.



DISCUSSION

This study examined factors contributing to acute heart failure (AHF) in patients at Mardan Medical Complex. The mean age was 65.14 years, aligning with global data indicating higher heart failure prevalence among older adults (7). Gender distribution was nearly equal, with males at 50.3% and females at 49.7%, reflecting findings from other regional studies (8). Notably, 79.3% of patients had uncontrolled hypertension, underscoring its significant role in AHF development. This aligns with research identifying hypertension as a leading heart failure risk factor (9). Additionally, 69.7% of

patients had type II diabetes mellitus, consistent with studies linking diabetes to increased heart failure risk (10). Dyslipidemia was present in 62.8% of patients, supporting evidence that lipid abnormalities contribute to heart failure (11). Smoking was reported by 35.9% of patients, corroborating studies that associate smoking with elevated heart failure risk (12). Obesity was observed in 42.1% of patients, aligning with research identifying obesity as a significant heart failure risk factor (13). The prevalence of anemia in 50.3% of patients is noteworthy, as anemia has been associated with worse outcomes in heart failure patients (14). These findings highlight the multifactorial nature of AHF and underscore the importance of comprehensive risk factor management in preventing its onset.

Limitations

This study's retrospective design may introduce selection bias, and the single-center setting limits generalizability. Future research should include multicenter, prospective studies to validate these findings across diverse populations.

CONCLUSION

This study highlights the significant burden of acute heart failure (AHF) among patients at Mardan Medical Complex, with key contributors including uncontrolled hypertension, diabetes mellitus, anemia, and obesity. Advanced age and gender-specific variations further underscore the complexity of managing AHF in this population. These findings emphasize the need for targeted screening and management strategies, particularly focusing on modifiable risk factors such as hypertension and smoking, to reduce the incidence and severity of AHF. Clinically, integrating routine risk assessment and personalized interventions into patient care could improve outcomes and reduce hospital readmissions. Future research should explore regional disparities, genetic predispositions, and the long-term impact of early intervention strategies. Addressing these gaps could help optimize care and mitigate the growing burden of heart failure in similar settings.

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