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SHORT RESEARCH ARTICLE

Clinical Outcomes and Risk Factors in Acute Myocarditis Patients: Insights from El-Obeid Teachi ng Hospital

Khalid ME Eltalib[1,2], Abdelsalam Mohamed Hamad Elfaki[1,2], Eldisugi Humida (Eldisugi Hassan Mohammed Humida)[1,2], Ibrahim Adam Musa Idris[3], Mohamed Ahmed Agab Ahmad Agab[1,2] and Hussain Gadelkarim Ahmed[4,5*]

[1]*Department of Medicine, Faculty of Medicine, Kordofan University, El-Obeid, Sudan*

[2]*Coronary Care Unit, El-Obeid Teaching Hospital, El-Obeid, Sudan*

[3]*Department of Pediatrics, University of Kordofan and Obeid Teaching Hospital, El-Obeid, Sudan*

[4]*Prof Medical Research Consultancy Center, El-Obeid, Sudan*

[5]*Department of Histopathology and Cytology, FMLS, University of Khartoum, Sudan*

***Corresponding author:** *Hussain Gadelkarim Ahmed, Prof Medical Research Consultancy Center, El-Obeid; Department of Histopathology and Cytology, FMLS, University of Khartoum, Sudan*

Abstract

Background: Acute myocarditis (AM) is rapidly becoming recognized as a risk factor for adverse health consequences due to late presentation in Sudan. As a result, the current study aims to analyze the outcomes of patients who present with AM to the El-Obeid Teaching Hospital in Sudan's North Kordofan state.

Methodology: This prospective hospital-based investigation included 45 individuals hospitalized within two years due to a clinical diagnosis of acute myocarditis. We did not include patients who had a previous diagnosis of cardiovascular illness.

Results: In terms of electrocardiogram (ECG) examination, the majority of those who died had S-T segment (ST) abnormalities, followed by N abnormalities and Atrial Fibrillation (AF) abnormalities, accounting for 60%, 16.7%, and 13.3%, respectively. The majority of discharged cases were associated with ST, followed by AF and normal (N), accounting for 33.3%, 26.7%, and 26.7%, respectively, in sequential order. A total of 82.4% of patients who had both high systolic blood pressure (SBP) and diastolic blood pressure (DBP) died prematurely. The blood pressure distribution among both dead and discharged groups was generally similar in patients.

Conclusion: Acute myocarditis is an increasingly prevalent problem in the north Kordofan state of Sudan, and unfortunately, it often leads to unfavorable outcomes. Myocarditis is more prevalent among males and rural populations with lower education levels.

Keywords

Acute myocarditis, ECG, Sudan, El-Obeid, Cardiovascular disease

Introduction

Acute myocarditis (AM) is a condition that causes inflammation in the myocardium. Various factors, including infections and noninfectious triggers, can cause it. Sudden cardiac death due to electrical instability and arrhythmia is a highly concerning outcome of myocarditis [1]. Myocarditis is categorized into four types: Acute, fulminant, chronic active, and chronic persistent. AM accounts for the majority of myocarditis patients (65%) and is primarily caused by a viral infection. Non-infectious causes can also contribute to this condition, although they are somewhat uncommon. The myocardium might be involved either focally or diffusely [2].

AM is an emerging cardiomyopathy-inflammatory illness that affects millions worldwide, especially children and young people. The lack of symptom onset or progression patterns might lead to heart failure and severe arrhythmias. Remodeling-related myocardial fibrosis is linked to worse acute myocarditis outcomes. Recent molecular and immunological advances

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have illuminated the complex relationship between viral infections, immune imbalances, and genetic vulnerability [3].

However, AM can range from simple myocarditis to hemodynamic instability and ventricular arrhythmias. Nonetheless, all of these forms share the common feature of acute myocardial inflammation [4].

Despite the growing knowledge of pathophysiology, the task of diagnosing and treating the condition accurately and promptly continues to pose challenges, primarily due to its high heterogeneity. Consequently, numerous patients face a challenging prognosis, and those who do survive are susceptible to enduring long-term complications. Existing diagnostic methods, such as imaging and endomyocardial biopsy, can be costly and invasive and may not always be conducted in a timely manner to impact the progression of the disease. Thus, it is crucial to identify biomarkers that are accurate, cost-effective, and provide valuable prognostic information for screening and treatment purposes [5].

As far as we know, there is no available data on this issue from Sudan. As a result, this study focuses on evaluating the outcomes of patients who have been admitted to the El-Obeid Teaching Hospital in North Kordofan State, Sudan, due to acute myocardial infarction.

Materials and Methods

This study involved 45 patients who were admitted to the El-Obeid Teaching Hospital, North Kordofan state, Sudan, with a clinical diagnosis of myocarditis over a two-year period. We did not include any patients with a known history of cardiovascular disease. We meticulously crafted a data sheet to collect personal information, clinical presentation, and ECG and ECHO findings. We also assessed the levels of urea and creatinine.

Statistical Analysis

After preparing the data on a standard master sheet, the variables were entered into SPSS software for analysis. Percentages, frequencies, and cross-tabulations were obtained.

Results

The study included 45 patients (35 (77.8%) men and 10 (22.2%) females) aged 18 to 55, with a mean age of 36 ± 10.2. The majority of patients were between the ages of 26 and 35 (both sexes), accounting for 18/45 (40%), including 13/35 (37%) males and 5/10 (50%) females.

Approximately 30/45 (66.7%) patients (22/35 (63%) males and 8/10 (80%) females) were from rural areas, with the remaining 15 (32.3%) from metropolitan areas. The majority of patients had a basic or lower level of education, as seen in Table 1 and Figure 1. The majority of patients were farmers, followed by employees and housewives, accounting for 18/45 (40%), 16 (35.6%), and 5 (11.1%), respectively, as shown in Table 1 and Figure 2.

Table 2 and Figure 2 describe the study subjects' distribution by ECG, blood pressure, and outcomes. Out of the 45 patients, 30 (66.7%) died, while the remaining 15 (33.3%) were discharged.

Table 1: Distribution of the study subjects by demographic characteristics.

Variable	Males (n = 35)	Females (n = 10)	Total (n = 45)
Age			
< 25 years	8	1	9
26-35	13	5	18
36-45	4	3	7
46+	10	1	11
Residence			
Rural	22	8	30
Urban	13	2	15
Education			
Illiterate	15	4	19
Basic	16	3	19
Secondary	3	3	6
University	1	0	1
Occupation			
Farmer	17	1	18
Worker	13	3	16
Employee	4	0	4
Housewife	0	5	5
Student	1	1	2

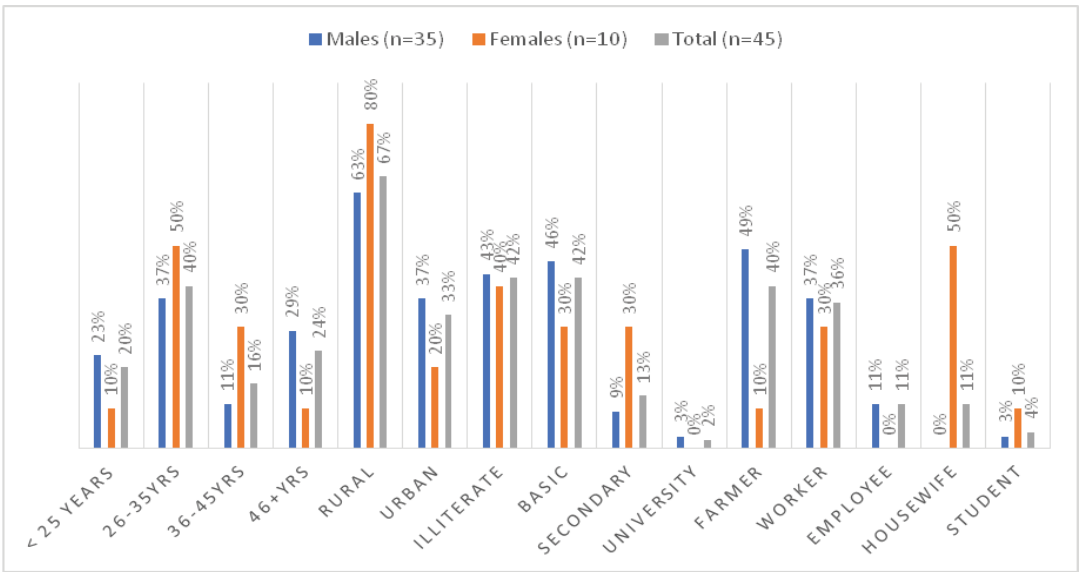

Figure 1: Depicts the patients' demographic features.

Table 2: Shows the distribution of research individuals by ECG, blood pressure, and outcomes.

Variable	Discharged (n = 15)	Died (n = 30)	Total (n = 45)
ECG			
AF	4	4	8
LBBB	0	2	2
N	4	5	9
Normal	1	0	1
ST	5	18	23
SVT	1	1	2
DBP			
0	3	14	17
30	0	1	1
40	0	2	2
50	0	1	1
60	3	3	6
70	5	5	10
80	2	3	5
90	2	1	3
SBP			
0	3	14	17
70	0	1	1
80	1	7	8
90	0	2	2
100	4	3	7
110	5	3	8
120	2	0	2

AF: Atrial Fibrillation; LBBB: Left Bundle Branch Block; SVT: Supraventricular Tachycardia

In terms of ECG examination, ST was the most common cause of death, followed by N and AF, accounting for 18/30 (60%), 5/30 (16.7%), and 4/30 (13.3%), respectively. The majority of discharged patients were sinus tachycardia (ST), followed by AF and N, accounting for 5/15 (33.3%), 4/15 (26.7%), and 4/15 (26.7%), respectively.

Approximately 14/17 (82.4%) of patients with low both systolic and diastolic blood pressure (SBP) had died. Other patients had roughly comparable blood pressure distributions between the dead and discharged groups, as shown in Table 2 and Figure 2.

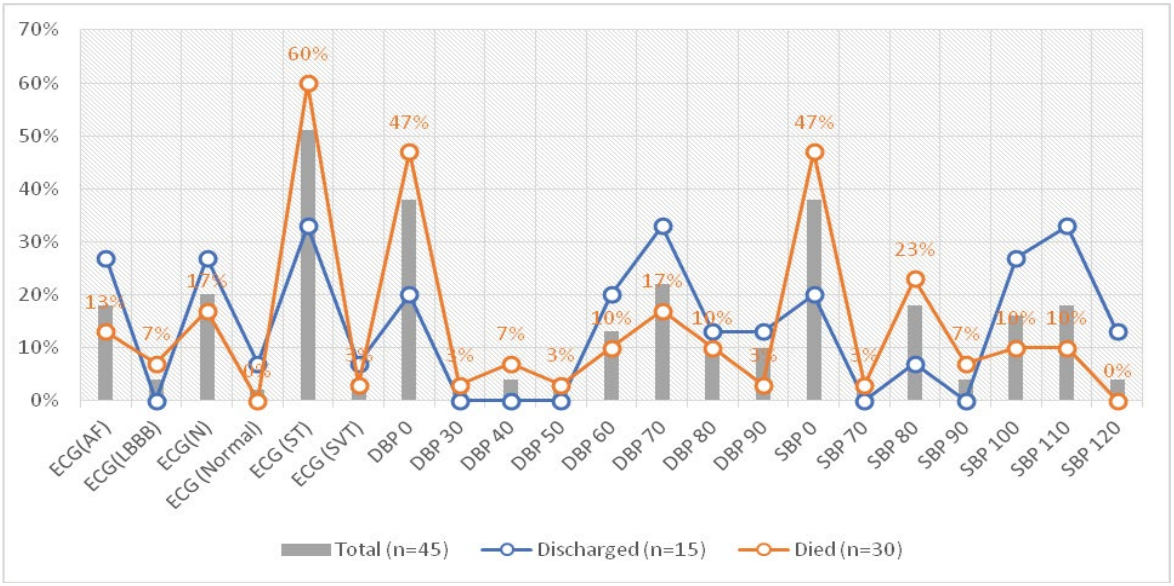

Figure 2: Description of patients based on ECG blood pressure and outcomes.

Table 3: Shows the distribution of research patients based on clinicodemographic variables and results.

Variable	Discharged (n = 15)	Died (n = 30)	Total (n = 45)
Gender			
Males	12	23	35
Females	3	7	10
Age			
≤ 25 years	5	4	9
26-35	6	12	18
36-45	2	5	7
≥ 46	2	9	11
Duration			
≤ 5 hours	3	9	12
5-9	6	6	12
10-14	5	12	17
≥ 15+	1	3	4
Urea level			
Normal	3	3	6
High	12	27	39
Creatinine level			
Low	2	0	2
Normal	5	11	16
High	8	19	27

Out of the 35 males, 23/35 (65.7%) died, so 7/10 (70%) of the 10 females died as well. Table 3 (Figure 3) shows that outcomes worsened with increasing age, which was statistically significant ($P < 0.05$). Although the duration of presentation was strongly associated with poor results, late presentation was only mildly associated with poor outcomes. High urea levels were associated with poor outcomes in both groups, with a relative risk (RR) and 95% confidence interval (95%CI) of 2.250 (0.395-12.803), $P = 0.3$. Both groups similarly raised their creatine levels (Table 3 and Figure 3).

Discussion

In Sudan, there is a scarcity of data regarding the epidemiology of myocarditis. In this study, we examined the outcomes of a cohort of patients admitted to our hospital due to acute myocarditis. This series consisted mainly of male patients, with a male-to-female ratio of 1.94:1.00. Approximately 89% of the female participants were under the age of 17. The majority of study subjects fell within the age range of 16 to 17 years, as depicted in Figure 1. There has been a growing academic interest in

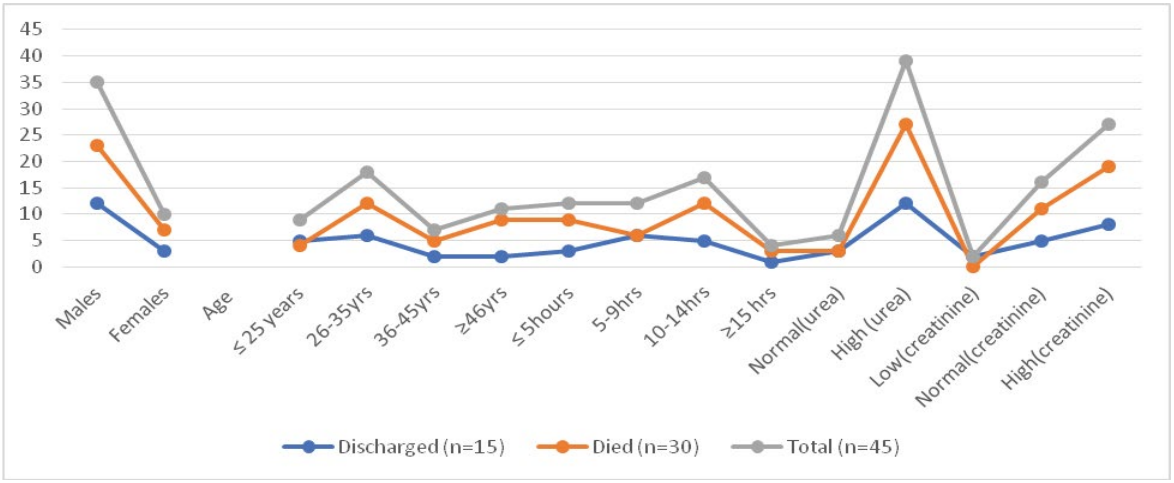

Figure 3: Patients by clinicodemographic characteristics and outcomes.

the differences between sexes and genders in relation to myocarditis and dilated cardiomyopathy (DCM) over the past decade. Surprisingly, there have been a significant number of clinical studies conducted in recent years that explore sex differences in myocarditis. Studies consistently show that myocarditis is more common in men compared to women, with a female-to-male ratio ranging from 1:2 to 4 [6].

The age range for both men and women in this series is between 26 and 35-years-old. Myocarditis can affect individuals at any stage of life, and the symptoms typically appear between 20 and 50 years of age [7,8].

Most of the patients were from rural areas and had not received considerable education. According to a similar study, the average age of the participants was 37.8 ± 17 years, and most of them were male. Approximately 87% of the participants were from rural areas, which is a considerable majority. Furthermore, a significant 73.3% of them had dyspnea grade III to IV for a period of 2 to 8 weeks [9]. We lack a thorough understanding of the differences between peripartum cardiomyopathy (PPCM) in rural and urban areas. There are major discrepancies between rural and urban hospitalizations with PPCM. Worse outcomes were related to urban hospitalizations, while rural PPCM hospitalizations were associated with greater transfers, indicating limited resources and advanced illness [10].

This study's results were devastating, with a mortality rate of 66.7 percent among participants. Patients with symptomatic acute myocarditis tend to experience a positive outcome overall. Patients with a left ventricular ejection fraction (LVEF) below 50% experienced a greater likelihood of adverse outcomes during their hospital stay compared to those with an LVEF of 50% or higher [11].

A significant number of individuals who passed away exhibited ST abnormalities on their electrocardiograms (ECGs), accounting for 60% of the cases. On an electrocardiogram (ECG), the ST segment is usually a spot where the electricity is not flowing between the depolarization (QRS complex) and repolarization (T wave) of the ventricles. However, it can exhibit a range of waveform morphologies, suggesting either a harmless or potentially serious myocardial infarction or injury. Having a good grasp of the differential diagnosis for changes in the ST segment is essential for effective clinical management, as it directly impacts treatment decisions [12]. ECG changes in acute myocarditis can provide valuable insights for clinicians to develop a personalized treatment plan, determine the appropriate length of hospital stay, and establish the frequency of follow-up appointments. The most common ECG abnormality in myocarditis is sinus tachycardia, which is accompanied by nonspecific ST/T-wave abnormalities. PR segment depression in both precordial and limb leads, PR segment depression in leads with ST segment elevation, PR segment elevation in an aVR lead, or ST elevation with a pericarditis pattern all indicate a likelihood of perimyocarditis rather than myocardial infarction. People who have been diagnosed with acute myocarditis and have certain electrocardiogram abnormalities, like pathological Q waves, broad QRS complexes, QRS/T angles ≥ 100°, prolonged QT interval, high-degree atrioventricular block, and malignant ventricular tachyarrhythmia, are less likely to get better. Conversely, a more favorable prognosis is associated with ST elevation and an early repolarization pattern [13].

Most of the individuals who sadly passed away in this study had declined systolic blood pressure. Compared to DBP, BP is a frequently observed cardiovascular risk factor, and it significantly influences blood pressure staging. However, it's important to note that this can vary depending on factors such as age, gender, and country [14].

During this investigation, the findings showed a consistent pattern across both genders. In addition, the length of the presentation had a significant impact on the quality of the results, whereas presenting late

only had a minor effect on the outcomes. There is a growing body of evidence suggesting differences in the epidemiology and pathophysiology of cardiovascular diseases based on gender. Emerging evidence suggests that there are notable disparities between males and females in the epidemiology and pathophysiology of cardiovascular diseases. Females, in particular, tend to have a more favorable natural course when it comes to various cardiovascular issues compared to males [15].

The current study's findings suggest a significant association between elevated levels of creatinine and urea and unfavorable outcomes. Myocarditis often involves a rapid disease progression that can lead to significant shock. Impaired renal function is a frequent occurrence among critically ill patients, resulting from a decrease in end-organ perfusion [16].

Although the sample size is small, the current study offers valuable insights into the prevalence of myocarditis in Sudan, a country with limited research on this particular subject.

In conclusion, acute myocarditis is an increasingly prevalent problem in the north-western Kordofan state of Sudan, leading to poor outcomes. Myocarditis is more prevalent among males and rural populations with lower levels of education. Further studies are crucial in this context to delve into different aspects of disease.

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