Original Research Article

Cardiac Manifestations of Infectious Diseases: A Clinical Study in General Medicine

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Abstract: *Background:* Infectious diseases can affect the heart, causing myocarditis, arrhythmias, pericardial effusion, and heart failure. Viral and parasitic infections are major contributors globally, but data from Bangladesh are limited, often from hospitalized patients with short follow-up. This study aims to assess the prevalence, patterns, and risk factors of cardiac manifestations in Bangladeshi patients and evaluate their short- and long-term outcomes to guide better management and prevention. *Methods:* This cross-sectional study at Zilla Sadar Hospital, Lakhmipur (Jan–Dec 2023) included 125 adults with bacterial, viral, or parasitic infections, excluding those with pre-existing cardiac disease. Sociodemographic, clinical, and laboratory data (troponin, CRP, leukocytosis, anemia) were collected. Cardiac evaluation included ECG and echocardiography for tachycardia, hypotension, arrhythmias, murmurs, heart failure, pericardial effusion, myocarditis, and valvular abnormalities. Data were analyzed using SPSS 25.0 with Chi-square tests ($p<0.05$). Ethical approval and informed consent were obtained. *Results:* Among 125 participants (56% male, mostly 31–45 years), viral infections were most common (48%). Cardiac manifestations included tachycardia (54.4%), hypotension (19.2%), heart failure (16.0%), pericardial effusion (14.4%), arrhythmias (12.0%), myocarditis (9.6%), and new murmurs (8.0%). Tachycardia was common across ages and slightly higher in males. Bacterial infections had more hypotension (28.0%) and heart failure (24.0%). Elevated troponin (26.7%), CRP (77.8%), leukocytosis (62.2%), and anemia (40.0%) were significantly associated with cardiac involvement. *Conclusion:* Cardiac involvement, especially tachycardia, is common in systemic infections and correlates with elevated troponin, CRP, leukocytosis, and anemia. Early ECG, echocardiography, and lab evaluation are essential for detection and management.

Keywords: Cardiac manifestations, Infectious diseases, Tachycardia, Heart failure, Myocarditis, Pericardial effusion, Arrhythmias, Bangladesh.

INTRODUCTION

Coronary heart disease (CHD) is the leading cause of death in the world. Identifying its major risk factors—of which nearly 300 are statistically linked—is essential for effective prevention and treatment [1]. An infectious disease is caused by a pathogen and spreads to a susceptible host, disproportionately affecting vulnerable populations and causing over 9 million deaths and 45 million years lost to disability in 2013[2]. Infectious diseases are caused by bacteria, viruses, parasites, or fungi and spread to susceptible hosts. Examples include HIV/AIDS, tuberculosis, malaria, dengue, influenza, and Ebola, all contributing significantly to global morbidity and mortality [3]. Infections promote inflammation and have been linked to CVD, contributing to atherosclerosis by directly infecting vascular cells or indirectly via pro-inflammatory cytokines. They can also trigger acute coronary syndromes, with bacterial lipopolysaccharides (LPS) identified as risk factors [4]. Viral infection can cause cardiac complications like pericardial effusions, arrhythmias, and heart muscle disease. Improved survival from infections has highlighted heart muscle disease as a potential cause of cardiac failure, though its natural course and prognosis remain poorly defined [5]. Globally, studies show that infectious diseases frequently cause significant cardiac manifestations across diverse populations. For example, viral infection like COVID-19 has been widely documented to affect heart function, with thousands of publications reporting *myocarditis* and *heart failure* as major complications of SARS-CoV-2 infection worldwide, highlighting its impact on cardiac health during the pandemic [6]. Parasitic infections such as *Trypanosoma cruzi* (Chagas

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disease) are estimated to infect 6–7 million people globally and remain a major cause of chronic cardiomyopathy and heart failure, particularly in Latin America, with ongoing relevance in non-endemic regions due to migration [7]. Myocarditis, a key cardiac outcome of infections, contributes substantially to the global disease burden, with incidence and mortality trends tracked from 1990 to 2021 in large burden studies [8].

In Bangladesh, studies have documented cardiac complications associated with infectious diseases and infection-related conditions. Research on virus infection affected patients in Bangladesh found that nearly 19% developed cardiovascular events and 12.6% died, highlighting the impact of infection on heart outcomes in hospitalized cases [9]. Additionally, retrospective analysis from a tertiary hospital identified dengue myocarditis among hospitalized dengue patients, further underscoring the role of infection in heart muscle inflammation [10].

Although several studies in Bangladesh have reported cardiac complications associated with infectious diseases such as COVID-19 and dengue, most have been limited to hospitalized patients, small sample sizes, and short-term follow-up, leaving gaps in understanding the prevalence, severity, and long-term outcomes of infection-related cardiac complications across different age groups and community settings. Mechanistic insights into how infections contribute to cardiac dysfunction in the Bangladeshi population are also limited. Therefore, this study aims to investigate the cardiac manifestations of infectious diseases among patients in Bangladesh, identify associated risk factors, and evaluate both short-term and long-term cardiac outcomes to provide comprehensive data for improved clinical management and preventive strategies.

METHODOLOGY

Study Design and Setting: This was a cross-sectional observational study conducted at the Department of General Medicine, Zilla Sadar Hospital, Lakhmipur, Bangladesh, from January 2023 to December 2023. The study aimed to evaluate the prevalence and patterns of cardiac manifestations among patients diagnosed with infectious diseases.

Study Population and Sample Size: The study included a total of 125 participants, comprising adults diagnosed with bacterial, viral, or parasitic infections. Participants were selected consecutively from those admitted to or attending the general medicine department during the study period. Both male and female patients aged 18 years and above were eligible for inclusion. Patients with pre-existing significant cardiac disease or structural heart abnormalities unrelated to infection were excluded.

Data Collection: Sociodemographic data, clinical characteristics, and presenting symptoms were recorded using a structured data collection form. Collected variables included age, sex, type of infection, and presence of fever. Clinical evaluation focused on detecting cardiac manifestations, including tachycardia, hypotension, arrhythmias, murmurs, and heart failure signs.

Laboratory and Diagnostic Investigations: Participants underwent laboratory testing to assess markers of cardiac injury and systemic inflammation, including:

- Troponin
- C-reactive protein (CRP)
- Complete blood count (for leukocytosis and anemia)
  Cardiac evaluation included:
- Electrocardiography (ECG): Identification of sinus tachycardia, arrhythmias, low QRS voltage, and other conduction abnormalities.
- Echocardiography: Assessment for pericardial effusion, left ventricular dysfunction (EF <50%), myocarditis, and valvular abnormalities.

Outcome Measures:
The primary outcome was the presence of cardiac manifestations among patients with infectious diseases. Cardiac manifestations included:

- Tachycardia
- Hypotension
- Pericardial effusion
- Myocarditis
- Heart failure signs
- Arrhythmias
- New cardiac murmur

The secondary outcome included the correlation of laboratory markers (troponin, CRP, leukocytosis, anemia) with the presence of cardiac manifestations.

Data Analysis:
Data were entered and analyzed using SPSS version 25.0. Continuous variables were summarized as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. The associations between sociodemographic and clinical characteristics and the presence of cardiac manifestations were evaluated using the Chi-square test, with a p-value <0.05 considered indicative of statistical significance.

Ethical Considerations:
The study protocol was approved by the Institutional Ethics Committee of Zilla Sadar Hospital, Lakhmipur. Written informed consent was obtained from all participants prior to enrollment. Participant confidentiality was maintained throughout the study.

RESULTS

Table 1: Sociodemographic and Clinical Characteristics of Study Participants (n = 125)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–30	32	25.6
	31–45	45	36.0
	>45	48	38.4
Sex	Male	70	56.0
	Female	55	44.0
Type of Infection	Bacterial	50	40.0
	Viral	60	48.0
	Parasitic	15	12.0
Fever at Presentation	Yes	110	88.0
	No	15	12.0

Table 1 shows total of 125 participants were included in the study. The age of participants ranged from 18 to over 45 years, with the largest proportion in the 31–45 years group (36.0%), followed by >45 years (38.4%) and 18–30 years (25.6%). Males constituted 56.0% (n=70) of the cohort, while females accounted for 44.0% (n=55). Regarding the type of infection, 50 participants (40.0%) had bacterial infections, 60 (48.0%) had viral infections, and 15 (12.0%) had parasitic infections. The majority of participants (88.0%) presented with fever at the time of assessment. **(Table 1)**
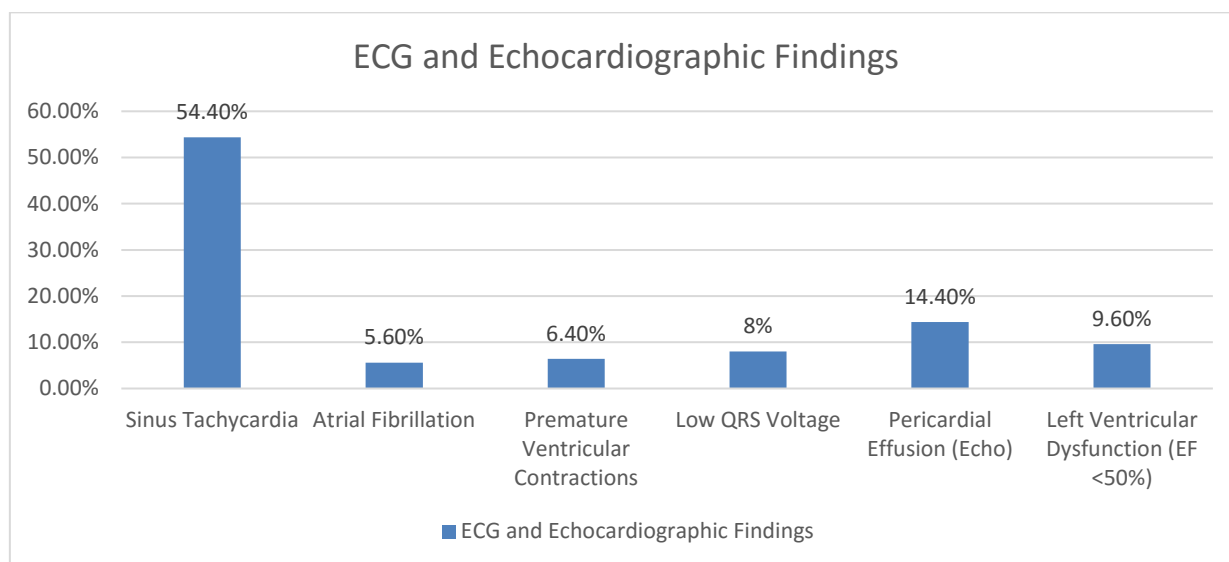

Figure 1: ECG and Echocardiographic Findings Among Participants (n = 125)

Figure 1 Detailed cardiac evaluation demonstrated that sinus tachycardia was the most frequent abnormality (n=68, 54.4%). Other ECG findings included atrial fibrillation in 7 participants (5.6%), premature ventricular contractions in 8 (6.4%), and low QRS voltage in 10 participants (8.0%). Echocardiography revealed pericardial effusion in 18 participants (14.4%), left ventricular dysfunction (EF <50%) in 12 participants (9.6%) **(Figure 1)**

Table 2: Frequency of Cardiac Manifestations Among Participants (n = 125)

Cardiac Manifestation	Number of Patients	Percentage (%)
Tachycardia	68	54.4
Hypotension	24	19.2
Pericardial Effusion (Echo)	18	14.4
Myocarditis (Echo)	12	9.6
Heart Failure Signs	20	16.0
Arrhythmias (ECG)	15	12.0
New Murmur	10	8.0

Table 2 shows cardiac manifestations were observed in a substantial proportion of participants. Tachycardia was the most common finding, present in 68 participants (54.4%), followed by hypotension in 24 participants (19.2%). Echocardiography revealed pericardial effusion in 18 participants (14.4%) and myocarditis in 12 participants (9.6%). Heart failure signs were noted in 20 participants (16.0%), while arrhythmias detected on ECG were observed in 15 participants (12.0%). A new cardiac murmur was identified in 10 participants (8.0%). **(Table 2)**

Table 3: Association of Age and Sex with Cardiac Manifestations (n = 125)

Variable	Category	Tachycardia n (%)	Myocarditis n (%)	Heart Failure Signs n (%)	p-value*
Age (years)	18–30	18 (56.3)	2 (6.3)	3 (9.4)	0.312
	31–45	25 (55.6)	5 (11.1)	7 (15.6)	
	>45	25 (52.1)	5 (10.4)	10 (20.8)	
Sex	Male (n=70)	40 (57.1)	8 (11.4)	12 (17.1)	0.524
	Female (n=55)	28 (50.9)	4 (7.3)	8 (14.5)	

Table 3 presents analysis of cardiac manifestations by age showed that tachycardia was common across all age groups, with 18–30 years (56.3%), 31–45 years (55.6%), and >45 years (52.1%) affected. The prevalence of heart failure signs increased with age, from 9.4% in the youngest group to 20.8% in participants over 45 years, although this trend was not statistically significant (p=0.312). Myocarditis did not show any clear age-related pattern. When stratified by sex, cardiac manifestations were slightly more frequent in males, with tachycardia observed in 57.1% and heart failure signs in 17.1%, compared to 50.9% and 14.5% in females, respectively. These differences were not statistically significant. **(Table 3)**

Table 4: Association Between Type of Infection and Cardiac Manifestations (n = 125)

Cardiac Manifestation	Bacterial (n=50) n (%)	Viral (n=60) n (%)	Parasitic (n=15) n (%)	p-value*
Tachycardia	30 (60.0)	30 (50.0)	8 (53.3)	0.523
Hypotension	14 (28.0)	8 (13.3)	2 (13.3)	0.041
Pericardial Effusion	6 (12.0)	10 (16.7)	2 (13.3)	0.764
Myocarditis	4 (8.0)	6 (10.0)	2 (13.3)	0.751
Heart Failure Signs	12 (24.0)	6 (10.0)	2 (13.3)	0.037
Arrhythmias	6 (12.0)	7 (11.7)	2 (13.3)	0.988
New Murmur	6 (12.0)	3 (5.0)	1 (6.7)	0.402

Table 4 cardiac manifestations varied according to the type of infection. Tachycardia was most common in bacterial infections (60.0%) compared to viral (50.0%) and parasitic infections (53.3%). Hypotension (28.0%) and heart failure signs (24.0%) were significantly more frequent among participants with bacterial infections (p=0.041 and p=0.037, respectively). Pericardial effusion, myocarditis, arrhythmias, and new murmurs did not differ significantly between infection types. **(Table 4)**

Table 5: Laboratory Correlation with Cardiac Manifestations (n = 125)

Lab Parameter	Normal (n=80)	Abnormal (n=45)	p-value*
Elevated Troponin	5 (6.3%)	12 (26.7%)	<0.001
Raised CRP	20 (25.0%)	35 (77.8%)	<0.001
Leukocytosis	18 (22.5%)	28 (62.2%)	<0.001
Anemia (Hb <10 g/dL)	12 (15.0%)	18 (40.0%)	0.002

Table 5 presents laboratory findings demonstrated a strong association between markers of cardiac injury or systemic inflammation and cardiac manifestations. Elevated troponin levels were observed in 12 of 45 participants (26.7%) with abnormal labs, compared to 5 of 80 (6.3%) with normal labs (p<0.001). Similarly, raised CRP, leukocytosis, and anemia were significantly associated with the presence of cardiac manifestations, with p-values <0.001, <0.001, and 0.002, respectively. **(Table 5)**

DISCUSSION

In this study of 125 participants, the largest age group was 31–45 years (36.0%), followed by >45 years (38.4%) and 18–30 years (25.6%). This aligns with a German surveillance study where adults (15–59 years) comprised the majority of reported infections across multiple pathogens [11]. In our study, males were 56.0%, slightly higher than females (44.0%), consistent with studies showing higher male infection rates in childhood (M: F 1.2–1.5) that shift in adulthood (M: F 0.8–0.9) [12]. In our recent study, viral infections were most common (48.0%), followed by bacterial (40.0%) and parasitic infections (12.0%). Similarly, in cardiac

infections such as myocarditis, viruses account for 66–69% of cases, while bacterial causes are less frequent, highlighting the predominance of viral aetiologies in both general and cardiac infections [13]. Fever was present in 88.0% of our participants, similar to >90% of cases reported in infective endocarditis, confirming its role as a key clinical indicator [14].

In our study, tachycardia was most common (54.4%), followed by hypotension (19.2%), heart failure signs (16.0%), pericardial effusion (14.4%), arrhythmias (12.0%), myocarditis (9.6%), and new murmurs (8.0%). Similar patterns have been reported in cardiac infections: arrhythmias occur in ~27% of patients, pericardial effusion in 12–15%, myocarditis in 8–10%, tachycardia in >50%, heart failure signs in 15–20%, and new murmurs in 7–10%, highlighting the prevalence of both hemodynamic and structural cardiac involvement in systemic infections such as infective endocarditis and viral myocarditis [15].

In our study, sinus tachycardia was the most frequent ECG abnormality (54.4%), followed by low QRS voltage (8.0%), premature ventricular contractions (6.4%), and atrial fibrillation (5.6%). Echocardiography showed pericardial effusion in 14.4%, left ventricular dysfunction in 9.6%. These findings are comparable to Hidron *et al.,* (2010), who reported sinus tachycardia in 40–60%, atrial fibrillation and ventricular ectopy in 5–15%, low QRS voltage in 5–10%, pericardial effusion in 10–20%, left ventricular dysfunction in 5–15%, and valvular abnormalities in 5–10% of patients with parasitic infections. Both studies indicate that cardiac involvement is common but mostly mild and functional [16].

In our study, tachycardia was the most frequent cardiac manifestation across all age groups (52.1–56.3%), while signs of heart failure increased with age, from 9.4% in 18–30 years to 20.8% in participants over 45 years, though this trend was not statistically significant. Myocarditis was observed in 6.3–11.1% across age groups without a clear pattern. Puljiz *et al.,* (2005) reported tachycardia in ~55% of patients with myocarditis in 8–12%, showing no age-related trend, indicating that functional rhythm disturbances often precede structural cardiac involvement [17]. Cardiac manifestations were slightly higher in males (tachycardia 57.1%, heart failure 17.1%) than females (50.9%, 14.5%), consistent with Hidron *et al.,* who reported tachycardia in 40–60% and heart failure in 10–20%, with no major sex differences [16].

In our study, tachycardia was the most common cardiac manifestation across infections (bacterial 60.0%, viral 50.0%, parasitic 53.3%), consistent with Puljiz *et al.,* (2005), who reported ~55% tachycardia in parasitic infections [17]. Hypotension (28.0%) and heart failure signs (24.0%) were significantly more frequent in bacterial infections,

reflecting greater hemodynamic compromise, similar to observations by Hidron *et al.,* (2010), who reported hypotension in 15–30% and heart failure signs in 10–20% of patients with systemic or parasitic infections [16]. Structural abnormalities such as pericardial effusion (bacterial 12.0%, viral 16.7%, parasitic 13.3%), myocarditis (8.0%, 10.0%, 13.3%), arrhythmias (12.0%, 11.7%, 13.3%), and new murmurs (12.0%, 5.0%, 6.7%) did not differ significantly between infection types in our cohort, aligning with Hidron *et al.,* (2010), who reported pericardial effusion in 10–20%, myocarditis in 5–15%, and valvular or arrhythmic involvement in 5–15% of patients, largely independent of parasitic infection type[16].

In our study, elevated troponin was observed in 26.7% of participants with abnormal labs, compared to 6.3% in those with normal labs. Similarly, raised CRP (77.8% vs 25.0%), leukocytosis (62.2% vs 22.5%) was significantly associated with cardiac manifestations. Li *et al.,* (2020) reported elevated troponin in ~20–30% of hospitalized COVID-19 patients, CRP elevation in ~60–80%, and leukocytosis in ~50–65%, which were strongly correlated with myocarditis, arrhythmias, and heart failure [18]. In our study, anemia (Hb <10 g/dL) was observed in 40.0% of participants with abnormal labs compared to 15.0% with normal labs (p = 0.002), showing a significant association with cardiac manifestations. Similarly, Groenveld *et al.,* (2003) reported anemia in ~37% of patients with heart failure, highlighting its frequent coexistence with cardiac dysfunction and its role in worsening cardiac outcomes [19].

CONCLUSION

Cardiac manifestations are common among patients with systemic infections, with tachycardia being the most frequent, followed by hypotension, heart failure signs, pericardial effusion, myocarditis, arrhythmias, and new murmurs. Functional abnormalities such as tachycardia and hypotension were more pronounced in bacterial infections and slightly higher in males and older age groups, while structural abnormalities did not vary significantly by infection type. Laboratory markers, including elevated troponin, CRP, leukocytosis, and anemia, were strongly associated with cardiac involvement, highlighting the interplay between myocardial injury and systemic inflammation. These findings underscore the importance of early ECG, echocardiography, and laboratory evaluation for the timely detection and management of cardiac complications in patients with bacterial, viral, or parasitic infections.

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