Cardiac Manifestations of Acute Febrile Illness Amongst Intensive Care Unit Patients

Hitesh More*, Gajanan Gondhali, Arun Daithankar, Amar Limbapure

Department of Medicine, MIMSR Medical College, Latur, India

*Corresponding Author: Hitesh More, Department of Medicine, MIMSR Medical College, Latur, India, E-mail: utkarshmbbs@gmail.com

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Abstract

Background: There are various incidences of cardiac involvement in acute febrile illness (AFI). As the acute febrile illnesses are spreading, there is an increase in atypical cardiac manifestations ranging from asymptomatic bradycardia to life threatening manifestations like myocarditis and pericardial effusion.

Objective: To determine cardiac manifestations of AFI amongst intensive care unit patients in rural populations.

Methods: Twenty patients of AFI were studied between January 2021 to June 2021. Echocardiography (ECG), and cardiac enzymes were evaluated. Patients were from either gender from 15 to 60 years and were willing to sign consent. patients admitted with fever and on examination were found abnormal cardiac functions like hypotension, arrhythmia, hypertension, cardiac enzyme changes and reduced ejection fraction on 2D Echo. Patients with preexisting heart disease, cardioactive drugs affecting the heart rate were not involved in this study.

Results: In total, 20 patients having cardiac manifestations with AFI were studied, out of which 9 cases presented with bradycardia, 3 cases presented with asymptomatic pericardial effusion, and 8 cases presented with ECG abnormalities such as narrow QRS complex, ST, and T changes.

Conclusion: Cardiac Manifestations in adults with AFI were common, ranging from elevated cardiac biomarkers to myocarditis. Persistent shock despite adequate fluid resuscitation can be a crucial cardiac manifestation and should guide the treating physician towards underlying cardiac involvement such as systolic or diastolic dysfunction.

Keywords: Bradycardia; APACHE score; Transient AV block; Transient ventricular tachycardia; Myocarditis; Pericardial effusion

Introduction

Temperature is most crucial vital signs to be observed in all cases, including critical care patients. Fever or hypothermia often makes it necessary for further physical evaluations, investigations, and treatment changes in critical
care patients. AFI is termed as non-localizing fever for ≥38 °C for >48 hours, with an onset of <14 days. According to the American College of Critical Care Medicine (ACCCM) and Infectious Disease Society of America (IDSA) joint task force, fever in an ICU patient is a single temperature of ≥101 degrees F or ≥38.3. Also, the ACCCM and IDSA suggest that fever in ICU should be investigated only if the temperature is ≥101 degrees F. Hyperpyrexia or hyperthermia is defined as a temperature exceeding 105.8 degrees F (or 41 °C) and is rarely seen in intensive care settings\textsuperscript{[1]}. In immunocompromised or neutropenic patients, a lower threshold should be measured for fever. Fever in a neutropenic ICU patient is defined as a single temperature exceeding than 101 degrees F (38.3 °C), or a temperature exceeding than 100.4 degrees F (38.0 °C) sustained for more than one hour in a patient with an absolute neutrophil count (ANC), not more than 500 cells/mm\textsuperscript{[2,3]}.

Fever is expected to provide a protective effect and help the host eliminate the invading organisms. Also, fever is related to increased mortality and morbidity in ICU cases and forms part of mortality prediction scores involving APACHE II & III. However, studies done on fever and mortality in ICU patients are unequivocal. A large epidemiological study done in 2008 had shown that a temperature ≥ 39.5 °C was associated with increased mortality in critically ill patients, and the mere presence of temperature ≥38.3 °C failed to produce any association with mortality\textsuperscript{[4]}. A study that was done subsequently published in 2012 reported that higher 28-day mortality observed with temperature more than ≥ 39.5 °C occurred in non-septic cases and not in cases with sepsis\textsuperscript{[5]}. Certain studies have also shown an inverse relation between fever and mortality in ICU and emergency patients\textsuperscript{[6,7]}.

As the spread of AFI increases atypical cardiac manifestations are also increasing and can range from asymptomatic bradycardia, transient AV block, transient ventricular arrhythmias to life-threatening manifestations like myocarditis and pericardial effusion\textsuperscript{[8-10]}. One review showed nine observational studies in patients admitted to the Intensive Care Unit without an acute neurological condition found that the fever incidence varied between 26 and 88%. Infections were responsible for 46% of febrile episodes\textsuperscript{[11]}.

This study focuses on determining cardiac manifestations of AFI amongst intensive care unit patients in rural populations. As patients of rural population, various cardiac manifestations occurring in patients of acute febrile illnesses have not been studied yet but this study will help to determine the prevalence of cardiac manifestations which will further help in awareness of these cardiac manifestations and thus help in treating them thus saving some precious lives.

**Materials and Methods**

In this descriptive observational study has been undertaken to study the cardiac manifestations of AFI among ICU patients. The changes in ECG, 2D Echo, and cardiac enzymes were studied in patients with AFI admitted in ICU. Sequential Organ Failure Assessment (SOFA) score assessment was as done as a composite measure of organ
dysfunction to determine the number of organ system failure. Multiple Organ Dysfunction Score (MODS) assessment was done to measure the deranged organ functioning, defined as ≥2 organ system failure. To study ECG changes like sinus bradycardia, sinus tachycardia (Normal Heart Rate-60 to 80 beats per minute) normal values for waves and intervals are-RR interval:0.6-1.2 seconds, PR Interval:120-200 milliseconds, P wave:80 milliseconds, T wave 160 milliseconds, ST segment :80-120 milliseconds. To study 2D Echo findings- An LV ejection fraction of 50 percent or higher is considered normal. An LV ejection fraction of 50 percent or lower is considered reduced. To study cardiac enzyme changes- creatine kinase (CK): normal range is 25-200 U/L, For isoenzyme of creatine kinase (CKMB), normal range 0-4 ng/mL. and for troponin:0-0.04 ng/mL.

It was a descriptive observational study with a duration of six months conducted at the department of Medicine, MIMSR Medical College, Latur. The study included cross-sectional record-based data from Jan 2021 to June 2021. The Sample size was 20, and the sampling technique used was a simple random sampling method.

**Inclusion criteria**

After signing the consent, critically ill adult patients from 15 to 60 years with a non-localizing fever for >48 hours and onset <14 days, with > 38.5℃ temperature for two consecutive days, were included in the study. Patients were confirmed to have abnormal cardiac functions like arrhythmia, hypotension, hypertension, cardiac enzyme changes, and reduced ejection fraction on 2D Echo.

**Exclusion criteria**

Patients with a previous history of cardiac illness like cardiomyopathies, coronary artery disease, and valvular heart disease, admission ECG suggestive of previous myocardial infarction were excluded. Patients on any medical therapy with cardioactive drugs affecting the heart rate (e.g., beta blockers, beta agonists, etc.) were excluded. Previously diagnosed patients with medical conditions posing increased risk for infections (such as HIV, primary immunodeficiency, malignancy, auto immune disorders, congenital lung/ cardiac disorders immunosuppressive therapy, indwelling hardware (shunt/prosthesis/catheters), or history of travel outside India in 4 weeks before the onset of illness were also excluded.

**Statistical analysis**

Data was gathered by using a structured proforma in MS excel sheet and analyzed using SPSS 24.0 version IBM USA. Qualitative data was expressed in the form of proportions. Quantitative data was expressed in the form of mean and standard deviation. Affiliation between two qualitative variables was seen using Chi square/ Fisher’s exact test. comparison of mean and standard deviation between two groups was done by using an unpaired t-test to evaluate whether the mean difference between groups is significant or not. Descriptive statistics of every variable was seen in
terms of mean, standard deviation, standard error of mean. A p value of <0.05 was considered statistically significant, whereas a p-value <0.001 was considered highly significant.

Results

In the present study, a total of 20 AFI patients admitted in ICU for the management of cardiac manifestations, ranging from elevated cardiac biomarkers to myocarditis. Total 12 patients (60%) of the total (20) Patients were in the age group of 45 to 60 years, 7 patients (35%) out of total 20 patients were from the age group of 31 to 45 years and only 1 patient (5%) was from the age group of 16 to 30 years as given in Table 1. There were 13 (65%) male and (7) 35% female with the ratio of 1.8:1. After 2D Echo, out of 20 patients’ pericardial effusion was observed in total 3 (15%) of cases while there were 17 cases (85%) which did not show any findings of pericardial effusion. Cardiac enzymes Troponin T were raised in 4 patients, that is 20% of cases, while CPKMB was positive 6 patients, that is 30% of cases and there were no changes in 10 patients, that is 50% of cases as given in Table 2. Many AFI do cause myocardial injury, either by direct invasion or autoimmune reaction resulting in myocardial inflammation. The cardiac abnormalities in AFI are transient and self-limited. Cardiac rhythm abnormalities range from asymptomatic bradycardia to severe myocarditis. Cardiac arrhythmias such as sinus bradycardia, junctional bradycardia, first-degree AV Block are seen.

Table 1: Demographic Profile of AFI patients
Table 2: Cardiac Enzymes-Troponin T was raised in 20% of cases and CKMB was raised in 30% of cases and 50% had no changes

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<th>CKMB (N=6)</th>
<th>No Changes (N=10)</th>
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Discussion
In recent years, a limited number of studies have focused on cardiac manifestations in AFI. The present study systematically investigated cardiac manifestations in acute febrile illness patients using ECG, 2D Echo, and cardiac enzymes like troponin I.
A prospective study was done by Ray et al. in 360 patients diagnosed with malaria and admitted in the various units of medicine. Twenty-seven cases were diagnosed as severe malaria (18 males and 9 females). Out of these, 24 were due to a protozoan parasite, *Plasmodium falciparum*. One case was reported due to protozoa *Plasmodium vivax* and two cases were of mixed infections. Seven cases of severe malaria were reported suffering from circulatory failure. Cardiovascular abnormalities were more common in *Plasmodium falciparum* malaria infected cases. Patients with circulatory failure presented with tachycardia, tachypnoea, decreased urine output, feeble pulse, and hypotension. The most common finding in ECG was sinus tachycardia (HR 120-150) in about 40% of the cases at the time of admission which settled down to the normal range within two to three days of treatment. Among them, 3.7% cases had premature atrial ectopics with tachycardia. About 7% of the patients showed sinus bradycardia (HR 40-60). A similar study was done in 120 patients suffering from cardiac manifestations due to dengue fever were present in 11.4% of our patients. Bradyarrhythmias (6.66%) were the commonest manifestations that resolves spontaneously within 7 to 14 days. LV Dysfunction was present in 3.3% of patients, which recovered within 3 months. Another study was conducted by Chintan Shah, et al. in which 320 patients who were selected for the study, almost 112 (35%) had changes of cardiac involvement and ECG. Sinus bradycardia in spite of fever was the most common abnormality (n = 63; 19.7%). Forty-two (13.1%) patients were having left ventricular ejection fraction less than 40%. Forty-eight patients (15%) were having increased serum levels of Troponin-T. Serum levels of CK-MB were raised in 34 (10.6%) and serum levels of NT-pro BNP was elevated in 19 (5.9%). Fourteen patients died who had abnormalities in electrocardiogram, echocardiogram and serum markers.

Another study was conducted by Mohit Arora and Rekha Patil showed that 44 (36.66%) patients had cardiac manifestations based upon abnormal cardiac enzymes and ECG. On admission 114 patients having sinus rhythm in ECG with 96 (84.21%) of them had normal heart rate, 10 (8.77%) had sinus bradycardia and 4 (3.51%) patients each having sinus tachycardia and NSST-T changes. Among 6 patients with abnormal rhythm at admission, 4 (66.67%) were having first degree AV block and 2 were having RBBB (33.33%). However, the second and third ECG done on day three and day seven (or at the time of discharge, whichever was earlier) were showing normal rhythm in all the patients (100%) which indicated transient rhythm abnormality. In the present study out of total 120 patients, 28 (23.3%) patients had both CK MB and troponin I elevated, 12 (10%) had only CK MB elevated and only 4 (3.3%) had only troponin I elevated. CK-MB and troponin-I levels in 76 (63.3%) patients were normal. Out of the total 120 patients enrolled in the study, 85 (70.83%) had dengue hemorrhagic fever, 20 (16.67) had dengue fever and only 15 (12.5%) patients had dengue shock syndrome. In this study, cardiac manifestation was found to be higher in patients with dengue shock syndrome with 8 (53.33%) out of 15 patients having cardiac enzymes elevation compared to 30 (35.29%) out of 55 and 6 (30%) out of 20 patients with dengue hemorrhagic fever and dengue fever respectively. Although the difference was not statistically significant (p=0.325).
Conclusion
Cardiac manifestations in adults with AFI were common, ranging from elevated cardiac biomarkers to myocarditis. Persistent shock despite adequate fluid resuscitation can be an important cardiac manifestation and should guide the treating physician towards underlying cardiac involvement such as systolic or diastolic dysfunction.

Ethical Approval: N/A
Conflict of Interest: Nil
Financial Disclosure: None

References


