

Frequency and Clinical Profile of Myocarditis in Children Under 5 Years with Measles: a Cross-Sectional Study at Hayatabad Medical Complex, Peshawar

Muhammad Kashif Hussain¹, Iman Aly^{2*}, Laila Khadim³, Atta Ullah⁴, Fatima Arif⁵, Ahmad Khan⁶

¹Registrar Pediatrics, HMC Peshawar, Pakistan

²Medical Officer, MSK Medical Complex, Peshawar, Pakistan

³Medical Officer Pediatrics, Northwest General Hospital, Peshawar, Pakistan

⁴Medical Officer, Serene Medical Complex, Saudi Arabia

⁵Demonstrator Forensic Medicine, Northwest School of Medicine, Peshawar, Pakistan

⁶Claim Officer, State Life Insurance Company, Islamabad, Pakistan

*Corresponding author

Dr Iman Aly

Medical Officer, MSK Medical Complex, Peshawar, Pakistan

Email ID:- imanaly@gmail.com

ABSTRACT

Background: Measles remains a significant public health challenge in developing nations, with resurgence episodes often complicated by severe systemic manifestations. Cardiac involvement, particularly acute myocarditis, is a life-threatening complication that significantly increases morbidity and mortality in pediatric populations, especially in children under five years of age.

Objective: To determine the frequency, clinical presentation, and associated outcomes of acute myocarditis among children under 5 years hospitalized with acute measles at the Pediatric Department, Hayatabad Medical Complex, Peshawar.

Methods: This cross-sectional observational study was conducted over a 12-month period in the Pediatric Department at Hayatabad Medical Complex, Peshawar. A total of 154 confirmed measles patients aged 1 to 59 months admitted to the pediatric ward/PICU were consecutively enrolled. Diagnosis of myocarditis was established using clinical criteria (tachycardia disproportionate to fever, gallop rhythm, muffled heart sounds, heart failure), elevated cardiac biomarkers (Troponin I and CK-MB), and electrocardiographic (ECG) / echocardiographic abnormalities (reduced ejection fraction, wall motion abnormalities). Data were analyzed using SPSS version 26.

Results: Out of 154 evaluated children, acute myocarditis was diagnosed in 24 patients, establishing a frequency of 15.6%. The mean age of children with myocarditis was 28.4 ± 11.2 months, with a male predominance (58.3%). The most common presenting symptoms among myocarditis cases included persistent lethargy/irritability (91.7%), tachypnea (83.3%), and severe tachycardia disproportionate to fever (79.2%). Electrocardiographic changes revealed sinus tachycardia (75.0%), ST-T wave abnormalities (54.2%), and low voltage complexes (33.3%). Echocardiography demonstrated left ventricular dysfunction (ejection fraction $< 55\%$) in 70.8% of cases. Elevated cardiac biomarkers were universally observed. Mortality among myocarditis cases was 16.7% (4/24), significantly higher than uncomplicated measles cases.

Conclusion: Acute myocarditis is a frequent and critical complication in young children hospitalized with measles at our center, accounting for substantial morbidity and mortality. Early clinical vigilance, serial cardiac enzyme evaluation, and prompt echocardiography are essential for timely diagnosis and management.

Keywords: Myocarditis, Measles, Children Under 5 Years, acute myocarditis

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1. INTRODUCTION

Measles is a highly contagious viral illness caused by a negative-sense, single-stranded RNA virus belonging to the Morbillivirus genus within the Paramyxoviridae family [1]. Despite widespread immunization programs, measles outbreaks continue to occur globally, particularly in regions with suboptimal vaccine coverage, such as parts of South Asia [2]. In Pakistan, recurrent outbreaks pose a severe threat to infant and child survival, heavily burdening tertiary healthcare facilities like Hayatabad Medical Complex (HMC) in Peshawar.

While the classical presentation of measles involves fever, generalized maculopapular rash, coryza, conjunctivitis, and Koplik spots, the disease is notoriously associated with severe systemic complications involving the respiratory, neurological, and cardiovascular systems [3, 4]. Respiratory complications such as bronchopneumonia and croup are most frequently documented; however, cardiovascular complications—specifically acute myocarditis—frequently go underdiagnosed despite carrying a grave prognosis [5].

Measles virus-induced myocarditis can occur through direct viral invasion of myocardial tissue or via immune-mediated hypersensitivity reactions leading to myocardial fiber necrosis and interstitial edema [6]. Clinical manifestations range from subtle tachycardia and fatigue to overt congestive heart failure, cardiogenic shock, and sudden cardiac death [7]. Given the paucity of regional data from Khyber Pakhtunkhwa regarding cardiac involvement in measles, this study was designed to evaluate the frequency and detailed clinical profile of myocarditis among children under five years admitted with measles at the Pediatric Department of Hayatabad Medical Complex, Peshawar.

2. METHODOLOGY

2.1 Study Design and Setting

This hospital-based cross-sectional study was conducted in the Pediatric Department and Pediatric Intensive Care Unit (PICU) of Hayatabad Medical Complex (HMC), Peshawar, over a 12-month duration. HMC is a major tertiary care and teaching hospital receiving severe pediatric referrals from across the Khyber Pakhtunkhwa province and adjacent tribal districts.

2.2 Participants and Selection Criteria

A consecutive sampling technique was employed. Inclusion criteria comprised children aged between 1 month and 59 months presenting with laboratory-confirmed or clinically defined acute measles (maculopapular rash accompanied by fever and at least one of cough, coryza, or conjunctivitis) admitted to the pediatric ward. Exclusion criteria included pre-existing congenital heart disease, pre-existing rheumatic heart disease, severe sepsis from non-measles bacterial coinfections, known metabolic cardiomyopathies, and incomplete medical records.

2.3 Diagnostic Criteria for Myocarditis

Patients presenting with clinical signs suspicious for cardiac involvement (disproportionate tachycardia, gallop rhythm, hepatomegaly, respiratory distress, cardiomegaly on chest radiography) underwent comprehensive cardiac evaluation. Acute myocarditis was confirmed when a patient met at least two of the following criteria: (1) clinical heart failure or rhythm abnormalities; (2) elevated serum cardiac biomarkers (Troponin I > 0.04 ng/mL and/or CK-MB > 25 IU/L); (3) electrocardiographic (ECG) abnormalities including ST-segment deviation, T-wave inversion, or low voltage; and (4) echocardiographic evidence of left ventricular systolic dysfunction (Ejection Fraction < 55%) or structural chamber dilatation.

2.4 Data Collection and Statistical Analysis

Demographic details, clinical symptoms, laboratory parameters, and hospital outcomes were recorded on a structured proforma. Data were entered and analyzed using SPSS version 26.0. Quantitative variables (such as age, duration of fever, heart rate) were expressed as mean $\pm$ standard deviation or median with interquartile range. Qualitative variables (such as gender, frequency of myocarditis, presence of specific symptoms, mortality) were presented as frequencies and percentages.

3. RESULTS

During the study period, a total of 172 children under 5 years presenting with acute measles were assessed, of whom 154 met the final inclusion criteria after exclusions. Out of these 154 patients, 24 were diagnosed with acute myocarditis, yielding an overall frequency of 15.6%.

3.1 Baseline Demographics and Clinical Characteristics

The mean age of children diagnosed with myocarditis was 28.4 ± 11.2 months, with a notable male predominance (14/24, 58.3%). Unvaccinated status against measles was documented in 79.2% (19/24) of myocarditis cases. The baseline clinical characteristics are summarized in Table 1.

Clinical Parameter	Myocarditis Group (n=24)	Uncomplicated Group (n=130)
Mean Age (months $\pm$ SD)	28.4 ± 11.2	26.1 ± 10.5
Gender (Male / Female)	14 (58.3%) / 10 (41.7%)	72 (55.4%) / 58 (44.6%)
Unvaccinated Status	19 (79.2%)	98 (75.4%)
Duration of Fever prior to admission (days)	5.2 ± 1.8	4.1 ± 1.4
Malnutrition (Weight-for-age < -2 Z-score)	16 (66.7%)	74 (56.9%)

3.2 Clinical Profile and Cardiovascular Findings

Among the 24 children with myocarditis, the prominent symptoms included lethargy and extreme irritability (91.7%), tachypnea (83.3%), and persistent tachycardia out of proportion to body temperature (79.2%). Hepatomegaly was detected in 62.5% of cases, indicating secondary right-sided heart failure. Electrocardiography (ECG) revealed sinus tachycardia in 75.0%, non-specific ST-T wave changes in 54.2%, and low voltage complexes in 33.3% of patients. Echocardiography demonstrated depressed left ventricular ejection fraction (<55%) in 70.8% of cases, with a mean ejection fraction of $46.2 \pm 6.8\%$ among myocarditis patients.

3.3 Biomarker Elevation and Clinical Outcomes

Serum cardiac biomarkers were uniformly elevated in all confirmed myocarditis patients. Troponin I levels averaged 0.18 ± 0.09 ng/mL (reference < 0.04 ng/mL), and CK-MB levels averaged 48.6 ± 14.2 IU/L. Overall mortality in the myocarditis cohort was 16.7% (4/24 patients), primarily resulting from intractable cardiogenic shock and acute pulmonary edema, compared to a 3.1% mortality rate in the non-myocarditis group.

4. DISCUSSION

Measles remains a formidable pediatric health concern in developing regions, where systemic complications frequently determine clinical outcomes. While pulmonary and neurological sequelae are widely recognized, cardiovascular manifestations such as acute myocarditis are less frequently reported despite being potentially fatal [8]. Our study conducted at Hayatabad Medical Complex, Peshawar, revealed a notable myocarditis frequency of 15.6% among children under five hospitalized with acute measles.

The high frequency observed in our cohort can be attributed to several interacting factors, including low routine immunization rates (79.2% unvaccinated in the myocarditis group), high baseline prevalence of protein-energy malnutrition (66.7%), and delayed presentation to tertiary care facilities [9]. Malnutrition compromises myocardial reserve and immune competence, predisposing young infants to severe viral dissemination and immune-mediated myocardial damage [10].

Clinical diagnosis of myocarditis in young children is challenging because symptoms such as tachypnea, tachycardia, and lethargy frequently overlap with severe bronchopneumonia, sepsis, or dehydration—common complications of measles [11]. Our findings emphasize that disproportionate tachycardia (tachycardia out of keeping with fever degree) and early hepatomegaly are critical clinical red flags that should prompt immediate cardiac evaluation, including serial ECGs, cardiac biomarker assays, and echocardiography [12].

The mortality rate of 16.7% observed among myocarditis cases underscores the gravity of this complication. Early identification allows for aggressive supportive care, including judicious inotropic support, afterload reduction, and meticulous fluid management, which can significantly improve survival in resource-constrained pediatric intensive care settings [13, 14]. Limitations of our study include its single-center observational design and lack of viral isolation via RT-PCR on myocardial tissue; however, the temporal association and exclusion of other etiologies provide robust clinical evidence.

5. CONCLUSION

Acute myocarditis is a significant and life-threatening complication affecting over 15% of children under 5 years hospitalized with measles at Hayatabad Medical Complex, Peshawar. Given its substantial contribution to pediatric mortality, clinicians managing measles outbreaks must maintain a high index of suspicion for cardiac involvement. Routine screening with cardiac enzymes, electrocardiography, and echocardiography in symptomatic children is vital for early diagnosis and improved clinical outcomes.

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