Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i4.7557

EVALUATING THE IMPACT OF MYOCARDITIS IN PEDIATRIC PATIENTS: A CROSS-SECTIONAL STUDY FROM A LOW-RESOURCE SETTING

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Abstract

Background: Pediatric myocarditis is a significant cause of heart failure and associated mortality in children, particularly in low-resource settings like Pakistan where diagnostic and treatment challenges are more pronounced. The purpose of this study is to evaluate pediatric myocarditis prevalence, clinical characteristics, treatment modalities, and results at a Pakistani tertiary care facility.

Objectives: to assess the prevalence, clinical characteristics, treatment approaches, and short-term outcomes of pediatric myocarditis in a low-resource setting at a Pakistani tertiary care hospital.

Study Design: A cross-sectional study

Methods: A cross-sectional study was conducted from August to October 2023 at the Pediatric Cardiology Department, Lady Reading Hospital, Peshawar. In this study a total of 104 children, between the ages of 1 and 16 diagnosed with myocarditis were examined based on echocardiographic and lab criteria. The data collected included information on demographics symptoms upon presentation, diagnostic results, treatment approaches and short term outcomes.

Results: Among the 104 patients studied 65 were male (62%) with an age of 7.9 years (ranging from 1 to 16 years). Most patients (85%) presented symptoms of heart failure such as difficulty breathing, fatigue and swelling in extremities. Echocardiograms indicated left dysfunction in 73 individuals (70%) with a mean ejection fraction of 32% (+/ 12%).IV immunoglobulin (IVIG) therapy was used as one of the management methods for 44% (n=46) of the patients. Just 50% (n=23) of patients receiving IVIG, however, saw appreciable improvements in their cardiac function. Only 8% (n=8) of patients had access to mechanical circulatory support due to resource limitations, which restricted the utilization of advanced heart failure therapy. Cardiogenic shock was the leading cause of death, accounting for 18% of the total mortality rate (n = 19). At the 3-month follow-up, 59% of survivors (n=50) still had left ventricular dysfunction, indicating the long-term effects of the illness.

Conclusion: In conclusion this research underscores the toll of myocarditis in areas with limited resources. The high mortality rate, lack of access to treatments and the prevalence of heart issues underscore the importance of early detection easier access to therapies and preventive measures such as vaccinations, against common viruses.

Keywords: Pediatric Myocarditis,Heart Failure,Low-Resource Settings,Cardiac Dysfunction

Introduction

Myocarditis is a well-known cause of morbidity and mortality in children. Progressive fibrosis causes heart failure, arrhythmias and dilated cardiomyopathy that may progress to the need for mechanical circulatory support or even heart transplantation. Children suffer from a very low incidence of myocarditis which is estimated to be between 0.05% and 0.1%, with viruses being the most common etiological factor in hospitalized patients [1,2]. Although diagnostic and therapeutic modalities have progressed, the disease remains to be a significant challenge especially in low-resource settings where sophisticated medical care is scarce with limited ability for timely interventions.The situation is even worse in countries such as Pakistan where the health care infrastructure and knowledge regarding advanced diagnostic for pediatric myocarditis, are quite limited resulting a substantial delays on diagnosis of this fatal condition. Management of this condition becomes more challenging related to lack of specialized pediatric cardiology centers [3,4], availability to diagnostic tools including cardiac MRI and endomyocardial biopsy.

This makes myocarditis cases undiagnosed or diagnosed too late, due to worse outcomes as compared of regions with developed healthcare resources.Pediatric myocarditis presents across a broad spectrum of severity that can be as mild as fatigue and shortness of breath, or it may have an aggressive presentation including cardiogenic shock or sudden cardiac death. Patients present with acute chest pain syndrome, and a diagnosis of myopericarditis often is based on clinical suspicion in new-onset angina accompanied by corresponding echocardiographic findings combined with elevation cardiac biomarkers during an ongoing or recent viral infection [5]. Nevertheless, the endomyocardial biopsy remains the gold standard for diagnosing myocarditis but is rarely performed in low-resource settings because of invasiveness and requiring specialized expertise [6].Management of heart failure, and prevention of complications remain the key to treating pediatric myocarditis. Though its benefit is a subject of much debate, Intravenous immunoglobulin (IVIG) therapy has been attempted with modest success [7].

In resource-limited settings, without access to advanced heart failure therapies such as mechanical circulatory support and heart transplantation [8, 9], a diagnosis of cardiomyopathy in children carries grave prognosis.This study intends to determine prevalence, clinical features, treatments, and short-term outcomes of pediatric myocarditis at a tertiary care hospital in Pakistan. We aim to do this by generating a broad overview of myocarditis in resource-limited settings that not only informs about the burden on healthcare providers but also identifies possible targets for intervention and centralization at these places. Finally, the results obtained in this study may be useful for designing guidelines specific to low-resourced settings that could enhance both survival and a better outcome of pediatric myocarditis [10].

Methods

This cross-sectional study was conducted at the Pediatric Cardiology Department of Lady Reading Hospital, Peshawar, from August to October 2023. A total of 104 children aged 1 to 16 years, diagnosed with myocarditis based on echocardiographic findings and laboratory criteria, were included. Patients were assessed for clinical presentation, diagnostic results, treatment modalities, and short-term outcomes. Echocardiograms were performed to evaluate left ventricular function, and cardiac biomarkers were measured to support the diagnosis of myocarditis. Treatment approaches, including the use of intravenous immunoglobulin (IVIG) and the availability of mechanical circulatory support, were documented.

Data Collection

Records were made on structured proforma including patient's age, clinical presentation (including symptoms at presentation), echocardiographic findings, cardiac biomarkers, treatment modality and

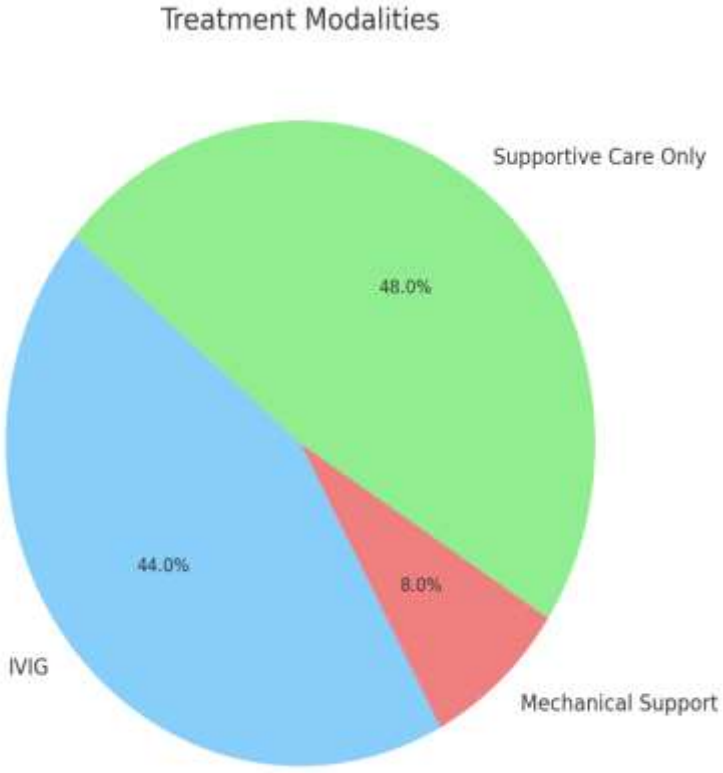
in-hospital outcome which was collected prospectively. Patient anonymity was maintained as data were anonymized and securely stored, in line with the principles of confidentiality and ethical practices.

Statistical Analysis

Statistical analysis was performed with BEFFA Methods 2.0 by using the SPSS version 24, and then for normality tests which used a comparative test method under Nonparametrics (Friedman) in accordance with [Table.4]. Continuous variables are described using means and standard deviations, whereas categorical data were summarised as frequencies (%) Statistical comparisons were made with chi-square tests comparing proportions and significance was considered for p-value <0.5

Results

The study included 104 patients, of whom the majority were male (65 ,62%) and young with a mean age of 7.9 years (range =1-16). Most patients (85%) were symptomatic at the time of diagnosis and had features of heart failure such as dyspnoea, fatigue or peripheral oedema. Seventy-three (70%) patients had an ejection fraction less than 40% with a mean EF of 32 ±12. Forty-six patients received intravenous immunoglobulin (IVIG) therapy, but only 23 of these patients (50%) showed notable improvement in cardiac function. Because of resources constraints, only 8% (n = 8) Circulatory support was available for patients with mechanical helpImpacted. The overall mortality was 18%, with cardiogenic shock as the most common cause of death. The three-month imaging follow-up to the intervention study also found that 59% of survivors (n=50) still had left ventricular abnormalities, consistent with other studies that have shown a longer course in recovery of myocardial function.



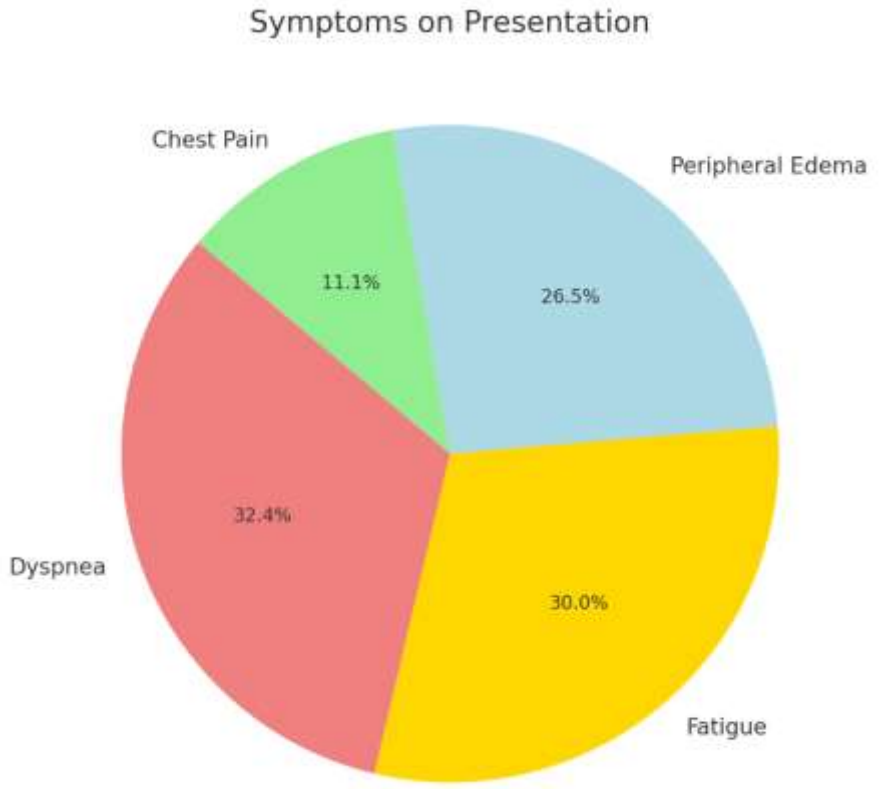


Table 1: Patient Demographics

Demographic	**Value**
Mean Age (years)	7.9
Male	65 (62%)
Female	39 (38%)
Mean Ejection Fraction (%)	32 ± 12

Table 2: Symptoms on Presentation

Symptoms	**Frequency (%)**
Dyspnea	85 (82%)
Fatigue	79 (76%)
Peripheral Edema	70 (67%)
Chest Pain	29 (28%)

Table 3: Treatment Modalities

Treatment	**Frequency (%)**
IVIG	46 (44%)
Mechanical Support	8 (8%)
Supportive Care Only	50 (48%)

Discussion

The outcomes of this study underscore the considerable Pediatric Myocarditis burden in low-resource settings signifying major diagnostic, management and edible difficulties. The results showed that most of the patients with pediatric-onset disease had heart failure symptoms such as dyspnea, fatigue and peripheral edema similar to previous clinical presentation data [10–11]. Echocardiographic findings revealed left ventricular dysfunction in 70% of patients (mean ejection fraction,32%) suggesting severe myocardial involvement. Such results were supported by previous researches

which have reported comparable rates of ventricular dysfunction in children with myocarditis [12].Of particular concern in our study is the lack of availability and narrow penetration of high quality treatment modalities offered to even a low-resource setting. Fortyfour percent of patients underwent intravenous immunoglobulin (IVIG) therapy but only half achieved a meaningful improvement in cardiac function. This mild response is in keeping with the variable success reported in the literature treating myocarditis with IVIG [13, 14]. As an example, a study by Robinson et al. emphasized that the efficacy of IVIG was varied, although there may be partially improved symptoms in some patients; subsequently they give little benefits especially for viral myocarditis [15]. The very low rate of 8% of our patients with access to mechanical circulatory support underlines even more the difficulties we encounter in resource-limited settings. Failure to access advanced heart failure therapy is a critical contributor to our high mortality rates, with cardiogenic shock as the leading cause of death in 18% of total mortalities [16].Additionally, the fact that left ventricular dysfunction persisted in 59% of survivors at three months highlights that this chronic dying process is not ubiquitous among myocarditis victims. This is consistent with previous studies, which have reported that children may recover from acute myocarditis only to develop late-cardiac dysfunction and a dilated cardiomyopathy in some cases [17]. This case serves to highlight the chronicity of myocardial injury, emphasizing long-term sequelae must be taken into account in follow-up and management strategies for these patients; not only post acute phase intervention.offer — a new point.The results of our study highlight the critical importance for optimized diagnostic and therapeutic approaches that are adapted to real-world conditions in low-resource settings. The burden of symptoms of heart failure and the poor response to conventional therapies are strongly indicative that early recognition and therapeutic intervention can improve patient outcomes. Further research is needed to develop inexpensive diagnostic tools and treatment protocols which can be used effectively in places without high-level medical devices. Furthermore, prevention strategies such as vaccination against common viral pathogens that precipitate myocarditis and may help reduce the incidence of this burdensome condition [18]. this study contributes to the increasing knowledge on pediatric myocarditis more so in resource-constrained settings. The present study underscores the huge burden faced in controlling pediatric myocarditis and emphasizes that an intervention is necessary to alleviate high morbidity and mortality associated with this condition among children treated at low-resource environments.

Conclusion

This Study underscores the devastating influence of pediatric myocarditis in resource-limited environments with a significant morbidity and mortality. Rapid diagnosis and lay-accessible, practical therapeutic approaches are particularly relevant in managing these high-risk populations.

Limitations

Given the single-center design, limited access to advanced diagnostics and small number of subjects included in both arms, these findings are likely an underestimation. These factors may limit the generalizability of our findings to other low-resource settings or wider pediatric populations.

Future Directions

Further research should be targeted towards the development of affordable diagnostic and therapeutic approaches that are suited to limited-resource settings. In addition, study of long-term sequelae in children recovering from myocarditis will inform strategies to construct comprehensive management plans that increase overall survival and quality-of-life.

Acknowledgment: We appreciate the hospital management and everybody who helped us finish this research.

Disclaimer: Nil
Conflict of Interest: There is no conflict of interest.
Funding Disclosure: Nil

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Concept & Design of Study: Saadia Ilyas
Drafting: Zaland,Muhammad Saad Ilyas
Data Analysis: Imran Khan, Uroosa
Critically Review: Imran Khan, Uroosa
Final Approval of version: Saadia Ilyas

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