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Evaluation of Cardiac Involvement in Pediatric Dengue Fever Through Troponin I and CPK-MB Correlation

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Abstract

Introduction: Dengue fever is a mosquito-borne viral illness increasingly associated with multisystem involvement, including cardiac complications. Paediatric cases are particularly vulnerable, with potential for myocardial injury that often goes unrecognized. This study aims to evaluate cardiac involvement in paediatric dengue patients through the measurement of serum biomarkers, primarily CK-MB and LDH, and their correlation with disease severity and liver enzyme levels.

Materials & Methods: A retrospective observational study was conducted at a tertiary care hospital from August to October 2024, including 120 serologically confirmed dengue patients, of whom 50 were pediatric (aged <14 years) and 70 were adults. Patients with pre-existing cardiac disease or incomplete records were excluded. Serum CK-MB, LDH, SGOT, and SGPT were measured using standard enzymatic assays. Data were analyzed using SPSS v25.0 with t-tests and chi-square tests; $p < 0.05$ was considered statistically significant.

Results: Among the 120 patients included, paediatric cases accounted for 41.6%. Males constituted 66.6% of the cohort. CK-MB levels were significantly elevated in adults compared to children (67.56 vs. 60.64, $p = 0.000$). LDH levels were high in both groups without a statistically significant difference. SGOT and SGPT levels rose proportionally with dengue severity, with significant differences in Grade 1 cases ($p = 0.001$). A strong correlation was found between CK-MB and elevated transaminase levels, indicating concurrent cardiac and hepatic involvement in paediatric patients.

Conclusion: The study demonstrates that CK-MB, SGOT, and SGPT are effective biomarkers for assessing the severity of dengue fever and potential myocardial involvement in paediatric populations. Elevated levels of these markers suggest the need for early cardiac evaluation to guide timely interventions. Routine cardiac biomarker assessment may aid in managing paediatric dengue cases with multisystem involvement.

Keywords: Dengue fever, CK-MB, LDH, SGOT, SGPT, Myocardial injury, Cardiac biomarkers

Introduction

Dengue fever is a fast-growing mosquito-borne viral illness caused by the dengue virus, a member of the Flaviviridae family, primarily spread by Aedes aegypti mosquitoes. The disease is endemic in more than 100 countries and poses a serious public health concern globally, especially across Asia, Africa, and South America. Children are particularly vulnerable to severe manifestations, such as dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS), both of which are linked to significant illness and death. [1,2].

Traditionally, dengue has been viewed as a self-limiting febrile illness; however, accumulating evidence suggests that it can result in multisystem involvement, including hepatic, neurological, and, notably,

cardiovascular complications [3]. Cardiac involvement in dengue, although under-recognized, can range from subtle electrocardiographic changes and transient myocardial depression to fulminant myocarditis and cardiogenic shock [4]. These manifestations are particularly concerning in the pediatric population, where early recognition and timely intervention are critical.

The viral invasion of myocardial tissue, immune-mediated injury, cytokine storm, or secondary effects of fluid overload and hypotension [5]. Given the non-specific clinical presentation and overlapping features with other systemic complications, objective assessment tools are essential for detecting myocardial injury. Biomarkers such as cardiac Troponin I and creatine phosphokinase-MB (CPK-MB) have been widely used as sensitive and specific indicators of myocardial damage in various infectious and non-infectious conditions [6]. The bloodstream upon myocardial cell injury and is considered a gold-standard marker for myocardial infarction and myocarditis in Troponin I [7]. Similarly, CPK-MB is an isoenzyme that increases in the early phases of myocardial injury and serves as an adjunct diagnostic marker [8]. Several studies in adult populations have demonstrated elevated levels of these biomarkers in dengue patients with cardiac involvement, but paediatric data remain sparse and inconclusive [9].

Echocardiography and clinical evaluation in conjunction with serum biomarkers may help identify myocardial dysfunction early, even before overt clinical symptoms develop. Establishing a correlation between cardiac biomarkers and functional parameters such as ejection fraction, fractional shortening, and hemodynamic stability can help stratify risk and guide treatment decisions in paediatric patients. [10,11]. This study aims to investigate the clinical correlation between serum levels of Troponin I and CPK-MB and echocardiographic cardiac function in children diagnosed with dengue fever. Identifying such correlations may pave the way for standardized cardiac screening protocols in paediatric dengue cases and facilitate early, targeted management of cardiovascular complications.

Materials & Methods

A retrospective observational study was conducted at a tertiary care teaching hospital from August to October 2024 to evaluate the possible cardiac involvement in patients with dengue fever by analysing specific biochemical markers of myocardial injury. The study included 120 patients with serologically confirmed dengue infection, comprising 50 children (aged 1–18 years) and 70 adults (above 18 years).

Inclusion and Exclusion Criteria

Patients were eligible for inclusion if they:

- Tested positive for dengue infection through NS1 antigen or IgM ELISA;
- Had complete biochemical profiles available; and
- Were admitted during the study period.

Patients were excluded if they had:

- A history of pre-existing cardiac disease (e.g., ischemic heart disease, cardiomyopathy, congenital heart defects);
- Co-infections such as malaria, typhoid, or leptospirosis; or
- Incomplete clinical or laboratory records.

Data Collection: Relevant data were obtained from the hospital medical record archives, including demographic characteristics, clinical presentation, dengue serology status, and laboratory findings. The biochemical markers assessed for evidence of myocardial injury were serum glutamic oxaloacetic transaminase (SGOT), creatine kinase-MB (CK-MB), and lactate dehydrogenase (LDH). These parameters were measured using standard enzymatic methods in the hospital's central biochemistry laboratory.

The cut-off values used to define abnormal results were:

- SGOT > 40 U/L,
- CK-MB > 25 U/L, and
- LDH > 480 U/L.

Where available, electrocardiogram (ECG) and echocardiography (ECHO) findings were reviewed to identify structural or functional cardiac abnormalities, providing supportive evidence for biochemical alterations.

Statistical Analysis: All collected data were entered into Microsoft Excel and analyzed using SPSS software version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including mean, standard deviation, and percentage, were used to summarize baseline characteristics and biochemical marker distribution among different age groups. Comparisons between children and adults were performed using the independent sample t-test for continuous variables and the Chi-square test (χ^2) for categorical variables.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Ethics Committee (IEC) of the tertiary care centre.

Results

Table 1: Age distribution among Study Participants

Age group in years	Frequency (n)	Percentage (%)
Paediatric ≤14 years	50	41.6
Adult> 14 years	70	58.4
Total	120	100

Out of the 120 patients included in the study, 50 (41.6%) were pediatric patients under 14 years of age, while 70 (58.4%) were adults above 14 years. This indicates a slightly higher proportion of adult dengue cases compared to pediatric cases in the study population.

Table 2: Gender distribution among Study Participants

Gender	Frequency (n)	Percentage (%)
Female	40	33.4
Male	80	66.6
Total	120	100

Among the 120 patients, 80 (66.6%) were male and 40 (33.4%) were female, showing a male predominance in the study population.

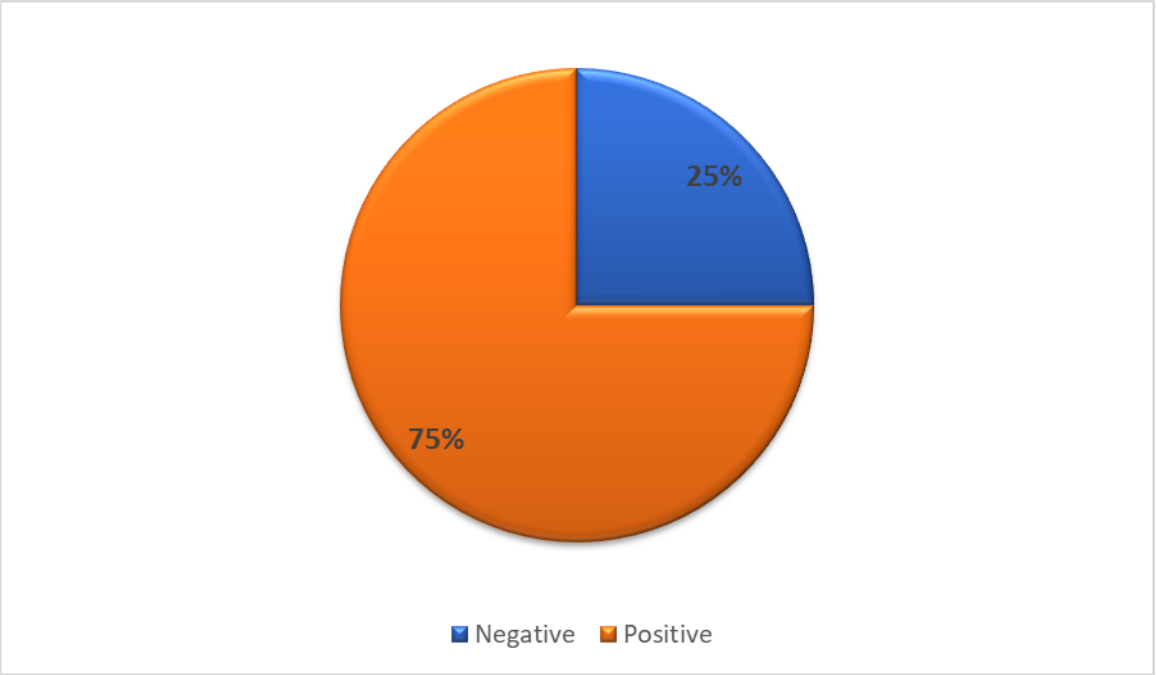
Table 3: Diagnosis

Diagnosis	Frequency	Percentage
Acute febrile illness	15	12.5
Chikungunya	2	1.6
Dengue	101	84.3
Enteric fever	2	1.6
Total	120	100

Among the 120 patients, dengue was the most common diagnosis, seen in 101 cases (84.3%). Acute febrile illness accounted for 15 cases (12.5%), while chikungunya and enteric fever were each diagnosed in 2 cases

(1.6%), indicating that dengue was the predominant cause of illness in this cohort.

Figure 1: Dengue



Out of the 120 patients, 90 (75%) tested positive for dengue using IgG, IgM, or NS1 antigen tests, while 30 (25%) were negative, confirming a high prevalence of dengue infection in the study population.

Table 4: Serum LDH and CKMB levels in Pediatric and adult patients diagnosed with dengue fever.

Variable	Age group		P value
	Paediatric	Adult	
CK-MB	60.64	67.56	0.000
LDH	1008.924	1015.494	

In your data, CK-MB levels are significantly higher in adults compared to pediatric patients, with a P-value of 0.000, indicating a strong statistical difference between the two groups. However, the LDH levels are quite similar between the two groups (pediatric: 1008.924, adult: 1015.494), and no P-value was provided for LDH, so it's unclear if this difference is statistically significant.

Table 5: SGOT and SGPT levels to assess the severity of dengue in study population.

	SGOT	SGPT	P value
Grade 1	166.80	139.58	0.001
Grade2	173.23	142.85	
Grade 3	188.67	149.21	

The SGOT and SGPT levels increase with the severity of dengue. For Grade 1 (mild), both SGOT and SGPT levels are significantly higher, with a P-value of 0.001, indicating a meaningful difference. For Grade 2 (moderate) and Grade 3 (severe), SGOT and SGPT also increase, but no P-values are provided, so it's unclear if these differences are statistically significant. In summary, SGOT and SGPT levels rise as dengue severity increases, with Grade 1 showing a significant change.

Table 6: correlation LDH and CKMB levels with SGOT and SGPT in this study population.

	SGOT	SGPT	P value
CK-MB	165.79±2.23	139.58 ± 4.15	0.01

LDH	173.23 ± 0.78	147.74 ± 0.36	

The data shows that CK-MB levels differ significantly between the two groups, with a P-value of 0.01 indicating a meaningful difference. However, for LDH, while the levels vary between the two groups, no P-value is provided, so it's unclear if the difference is statistically significant.

Table 7: clinical significance of these biomarkers in guiding early diagnosis

Parameters	Standard deviation
CK-MB	66.8464
LDH	1010.604924
SGOT	166.8067
SGPT	141.194958

CK-MB: 66.85, showing a moderate variability in the data; LDH: 1010.60, indicating a higher spread in LDH levels; SGOT: 166.81, reflecting the variability in SGOT levels; SGPT: 141.19, showing the spread in SGPT levels.

Discussion

In This study demonstrates a significantly higher prevalence of Helicobacter pylori infection among cirrhotic patients (69.4%) compared to non-cirrhotic individuals (37.1%), suggesting a potential association between chronic liver disease and increased susceptibility to H. pylori colonization. Similar observations have been reported in earlier studies, which proposed that immune dysfunction and alterations in gastric mucosal defense mechanisms in cirrhosis may facilitate persistent H. pylori infection (Pellicano et al., Tsai et al., Gupta et al.) [2,6,7].

The endoscopic findings also varied significantly between the two groups. Cirrhotic patients predominantly exhibited portal hypertensive gastropathy and esophageal varices, findings that are consistent with portal hypertension, whereas non-cirrhotic patients more frequently showed antral gastritis and gastroesophageal reflux disease, conditions commonly associated with H. pylori infection and acid-related mucosal injury (Marshall et al., Pellicano et al.) [1,8]. These differences highlight the distinct gastrointestinal manifestations associated with liver cirrhosis compared to non-cirrhotic conditions.

Biochemical analysis revealed that H. pylori-positive patients had significantly elevated serum bilirubin levels and prolonged PT/INR values, indicating more advanced hepatic dysfunction. Similar associations between H. pylori infection and worsening liver function parameters have been documented previously (Shiota et al., Liu et al.) [9,11]. Furthermore, the higher prevalence of H. pylori infection among patients with increased Child–Pugh scores suggests a correlation between infection and the severity of liver disease, as also noted by Pellicano et al. and Gupta et al. [2,7].

The observed association may be explained by mechanisms such as bacterial translocation, systemic inflammation, and altered gut–liver axis interactions in cirrhosis (Frances et al., Llorente et al.) [5,10]. These mechanisms may contribute to disease progression and exacerbate cirrhosis-related complications. Overall, the findings of the present study support the hypothesis that H. pylori infection may not merely coexist with chronic liver disease but could potentially aggravate its clinical course. This underscores the importance of early detection and consideration of eradication therapy for H. pylori in cirrhotic patients to possibly reduce disease-related complications and improve clinical outcomes.

Conclusion

In conclusion, our study suggests that CK-MB, SGOT, and SGPT are valuable biomarkers for assessing dengue severity, particularly in identifying liver involvement and myocardial injury. However, further research is required to validate the role of LDH and to explore its potential as a consistent marker for dengue severity. Comparisons with similar studies highlight the importance of understanding how biomarkers vary with disease progression and across different age groups in dengue patients.

Conflict of Interest: Nil

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