International Journal of Contemporary Pediatrics
Mandal DK et al. Int J Contemp Pediatr. 2025 Mar;12(3):430-436
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20250406

Original Research Article

A study on outcome of children with dengue infection and its clinical correlation with hepatidysfunction in a tertiary care hospital of Saurashtra

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Received: 25 December 2024
Revised: 03 February 2025
Accepted: 06 February 2025

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ABSTRACT

Background: Dengue infection in children can significantly impact hepatic function, yet the spectrum of liver involvement and its correlation with disease severity needs further exploration in pediatric populations.
Methods: A prospective observational study was conducted from July 2023 to July 2024 at a Guru Gobindsingh Government Hospital, Jamnagar in Saurashtra region, including 95 children aged 2 months to 12 years with suspected or confirmed dengue. Clinical assessments, dengue serology (NS1 antigen, IgM & IgG antibodies), liver function tests, coagulation profile, and complete blood counts were performed. The study evaluated hepatic dysfunction parameters and their correlation with disease severity.
Results: Males and the 6-10 years age group were predominantly affected. Fever and petechial rash were the most common presentations. Laboratory findings revealed thrombocytopenia (67.3%), elevated total serum bilirubin (33.3%), raised SGPT (53.75%), elevated INR (6.3%), and low serum albumin (26.3%). Disease classification showed DF (87.4%), DHF (11.6%), and DSS (1.1%). The mortality rate was 1.1%, with one death due to DSS.
Conclusions: Hepatic dysfunction in pediatric dengue presents a broad spectrum from mild enzyme elevation to severe hepatic failure. Significant liver enzyme elevation correlates with severe dengue manifestations. Seropositivity is associated with increased hepatic dysfunction and disease severity, emphasizing the importance of liver function monitoring in dengue management.

Keywords: Pediatric dengue, Hepatic dysfunction, Dengue serology, Liver enzymes

INTRODUCTION

Dengue infection is a major public health concern globally, particularly affecting tropical and subtropical regions including India. It causes significant morbidity and mortality across all age groups, with children being particularly vulnerable to severe manifestations. The clinical spectrum ranges from asymptomatic infection to severe disease with multi-organ dysfunction, making early recognition and management crucial for improved outcomes. Recent epidemiological data indicates a dramatic increase in dengue cases worldwide. According to WHO reports, dengue cases have risen from approximately 505,430 cases in 2000 to over 5.2 million in 2019, with 2023 recording an unprecedented spike of over 6.5 million cases and more than 7,300 dengue-related deaths globally.[1]

The dengue virus, despite being non-hepatotropic, frequently causes hepatic involvement during infection. Liver involvement in dengue can range from mild enzyme elevations to severe hepatic failure.[2] The pathogenesis involves both direct viral effects on hepatocytes and Kupffer cells, as well as immune-

mediated liver injury. High viremia levels correlate with more extensive liver involvement and poorer clinical outcomes. Multiple studies have established a significant association between the degree of hepatic dysfunction and disease severity. Hepatic involvement in dengue infection correlates with prolonged recovery time, increased risk of complications, and greater need for intensive care.[3] Elevated liver enzymes often precede the development of severe dengue manifestations, potentially serving as an early marker for disease progression.[4]

The challenges in early dengue diagnosis are noteworthy, as initial symptoms are often nonspecific, and serological tests typically become positive later in the disease course. Conventional markers like platelet count and hematocrit, while useful for identifying the critical phase, may not serve as reliable early prognostic indicators.

Several studies have emphasized the need for additional markers to predict dengue severity and guide clinical management. For instance, a systematic review and meta-analysis identified that early alterations in platelet count and aspartate aminotransferase (AST) levels within the first 72 hours of fever onset are independent markers predicting the development of severe dengue.[5] Another study highlighted that elevated serum ferritin levels have a significant positive correlation with dengue severity, suggesting its potential as a prognostic marker.[6]

Additionally, research has indicated that markers such as C-reactive protein (CRP), AST, and albumin, which are routinely measured even in resource-limited settings, can be useful in predicting severe manifestations of dengue.[7] These findings underscore the importance of incorporating additional biomarkers alongside conventional parameters to enhance early prediction of disease severity and improve patient management strategies.

Despite numerous studies on dengue in adults, research specifically focusing on hepatic dysfunction in pediatric dengue remains limited. Children present unique challenges in disease recognition and management, as they may rapidly progress from mild symptoms to severe disease. Understanding the pattern and significance of hepatic involvement in pediatric dengue could potentially improve early recognition of severe cases and guide appropriate intervention.

This study aims to study hepatic dysfunction in childhood dengue infection and clinical co-relation like severity, clinical feature, other lab parameters, morbidity and mortality.

METHODS

Study design and population

This prospective observational study was conducted at the Department of Pediatrics, Guru Gobindsingh Government Hospital and Shri M P Shah Government Medical College, Jamnagar, a part of Saurashtra region from July 2023 to July 2024. The study included 95 children aged 2 months to 12 years who were either clinically suspected or serologically confirmed cases of dengue infection. Sample size was determined based on the average annual dengue hospitalizations over the previous five years. Universal sampling technique was used for data collection.

Inclusion criteria

Children of both sexes up to 12 years of age with clinical features suggestive of dengue infection or serologically positive cases were included.

Exclusion criteria

Patients with pre-existing liver disease, history of hepatotoxic drug intake, or those whose parents refused consent were excluded from the study.

Ethical considerations

The study protocol was approved by the Institutional Ethics Committee. Written informed consent was obtained from parents/guardians after explaining the study purpose. Patient confidentiality was maintained throughout the study period.

Clinical assessment

Detailed medical histories were obtained from parents, including fever duration, vomiting, abdominal pain, and other symptoms. Anthropometric measurements and vital signs were recorded. Complete systemic examination was performed, including cardiovascular, respiratory, abdominal, and central nervous system assessment.

Laboratory investigations

Blood samples were collected following standard protocols using 22G needles. Investigations included, complete blood count (haemoglobin, total leukocyte count, absolute neutrophil count, platelet count, haematocrit). Dengue serology (NS1 antigen, IgM & IgG antibodies). Liver function tests (serum bilirubin, SGPT, serum albumin)

Coagulation profile (PT/INR)

Additional tests as clinically indicated (Widal test, malarial parasite)

Case definitions

Dengue cases were classified according to WHO criteria.

Dengue fever

Acute febrile illness of 2-7 days duration with two or more manifestations (headache, retro-orbital pain, myalgia, arthralgia, rash, haemorrhagic manifestations)

Dengue haemorrhagic fever

DF with haemorrhagic tendencies like, positive tourniquet test. Petechiae, ecchymosis, or purpura. Bleeding from mucosa, gastrointestinal tract, injection site or another site. Thrombocytopenia (<100000 cells per cubic mm). Evidence of plasma leakage due to increased vascular permeability manifested by a rise in average hematocrit for age and sex >20%. A more then 20% drop in hematocrit following volume replacement treatment compared to baseline. Signs of plasma leakage (pleural effusion, ascites, hyponatremia).

Dengue shock syndrome

DHF with circulatory failure manifested by rapid and weak pulse and narrow pulse pressure (<20% mmHg) or hypotension for age, cold and clammy skin and restlessness.

Statistical analysis

Data was analyzed using SPSS software version-2. Chi-square tests were used for categorical variables. P values <0.05 were considered statistically significant.

Declaration of artificial intelligence (AI) usage

In preparing this manuscript, we used AI language models (ChatGPT and Claude) solely for improving language and readability. These tools assisted with grammar and text fluency only. All scientific content, methodology, and conclusions are entirely our own work. AI tools are not listed as authors.

RESULTS

In present study which was carried out at Department of Pediatrics, tertiary care hospital of Saurashtra for a period of 12 month from July 2023 to July 2024. A total of 95 patients aged 2 month- 12 years diagnosed with either clinical or seropositive DF, DHF and DSS were included in the present study. Observation and results are discussed as under.

Table 1: Demographic characteristic and clinical features of the patients (n=95).

Characteristic	Frequency (N)	%
Age group (in years)		
<1	2	2.1
1-5	28	29.5
6-10	45	47.4
11-12	20	21.1
Gender		
Male	54	56.8
Female	41	43.2
Clinical features		
Fever	95	100
Pain abdomen	31	32.6
Myalgia	29	30.5
Headache	26	27.4
Joint Pain	9	9.5
Bleeding	8	8.4
Hepatomegaly	8	8.4
Jaundice	3	3.2
Petechiae/Purpura	10	10.5
Convulsion	1 (1.1%)	
Altered sensorium	3 (3.2%)	

This table presents the demographic distribution and clinical features of dengue patients. The majority (47.4%) were aged 6-10 years, with a slight male predominance (56.8%). Fever was universal (100%), followed by common symptoms like pain abdomen (32.6%), myalgia (30.5%), and headache (27.4%). Less frequent manifestations included bleeding (8.4%), hepatomegaly (8.4%), and altered sensorium (3.2%) (Table 1). The majority of cases were classified as Dengue Fever 87.4%, while 11.6% were diagnosed with Dengue Haemorrhagic Fever (DHF), and 1.1% developed Dengue Shock Syndrome (DSS). The outcome analysis showed 100% recovery in DF and DHF cases, while the single DSS

case resulted in mortality. The average length of hospital stay was 6.2±3.1 days (Table 2).

The relationship between platelet counts and liver dysfunction (as indicated by elevated SGPT) found not statistically significant (p=0.083), but there is a trend showing higher rates of elevated SGPT in patients with lower platelet counts. This suggests a possible association between the severity of thrombocytopenia and liver involvement in dengue, which may reflect the overall disease severity. This table explores the relationship between elevated SGPT (>40 U/l) and specific clinical features. While not statistically significant, there were trends towards higher rates of hepatomegaly (11.8% vs 4.5%), pain abdomen (39.2% vs 25.0%), and bleeding (11.8% vs 4.5%) in patients with elevated SGPT compared to those with normal SGPT. During our study period, number of severe dengue cases were less so larger studies may be needed to confirm these associations (Table 3).

This table compares key laboratory parameters between Dengue Fever (DF) and severe cases (DHF/DSS). Severe cases had significantly lower platelet counts (<50,000 in 66.7%, p=0.003), higher leukopenia (<4,000 in 75.0%, p=0.033), and elevated hematocrit (>35% in 66.7%, p=0.043). Low serum albumin (<3.0 g/dl) was more frequent in DHF/DSS (33.3%, p=0.009). Elevated total bilirubin (>1.0 mg/dl) showed a trend toward significance (33.3%, p=0.056) (Table 4).

DHF/DSS cases showed significantly higher rates of elevated SGPT (91.7% vs 48.2%, p=0.005) compared to DF cases (Table 5). The length of hospital stays correlated significantly with disease severity (p=0.001), with DF cases averaging 5.7 days, DHF cases 8.5 days, and the DSS case requiring 14 days (Table 6).

This table shows the mean length of stay (LOS) in days for dengue patients categorized by their classification (DF, DHF, DSS) and SGPT levels. The mean LOS for DF patients were 5.7±2.6 days, for DHF patients was 8.5±3.7 days, and for DSS patients was 14.0 days. The LOS was significantly higher for patients with SGPT levels between 41-200 U/l (6.7±3.4 days) compared to those with levels <40 U/l (5.3±2.1 days), and those with SGPT levels >200 U/l had the highest LOS (10.3±4.5 days) (Table 7). USG findings revealed a significant association between ascites and elevated SGPT (p=0.038), with 69.0% of patients with ascites showing elevated SGPT compared to 47.0% in those with normal USG findings (Table 8). Analysis of dengue seropositivity showed significant correlation with disease severity (p=0.032), with 22.0% of seropositive cases developing DHF/DSS compared to 5.6% of seronegative cases. Seropositive cases also showed higher rates of thrombocytopenia (48.8% vs 31.5%, p=0.041) and longer hospital stays (7.2 vs 5.6 days) (Table 9).

Table 2: Dengue classification and outcomes.

Characteristic	N (%) or Mean (SD)
Dengue classification	
Dengue fever (DF)	83 (87.4)
Dengue haemorrhagic fever (DHF)	11 (11.6)
Dengue shock syndrome (DSS)	1 (1.1)
Outcome	
DF	
Death	0
Discharge	83 (100)
DHF	
Death	0
Discharge	11 (100)
DSS	
Death	1 (100)
Discharge	0
Length of hospital stay (days)	6.2±3.1

Table 3: Correlation between platelet count and clinical features with hepatic dysfunction.

	Elevated SGPT (>40 U/l)	Normal SGPT (≤40 U/l)	P value
Platelet count (×10³/µl)			
<50,000	10/13 (76.9%)	3/13 (23.1%)	0.083
50,000-100,000	15/24 (62.5%)	9/24 (37.5%)	
100,000-150,000	14/27 (51.9%)	13/27 (48.1%)	
>150,000	12/31 (38.7%)	19/31 (61.3%)	

Continued.

	Elevated SGPT (>40 U/l)	Normal SGPT (≤40 U/l)	P value
Clinical feature			
Hepatomegaly	6/51 (11.8%)	2/44 (4.5%)	0.204
Pain abdomen	20/51 (39.2%)	11/44 (25.0%)	0.141
Bleeding	6/51 (11.8%)	2/44 (4.5%)	0.204

*p-value <0.05 – significant, **p-value <0.001 – highly significant.

Table 4: Correlation between laboratory parameters and dengue severity.

Laboratory parameters	DF (n=83)	DHF/DSS (n=12)	P value
Platelet count			
<50,000	20 (24.1%)	8 (66.7%)	0.003*
50,000-100,000	25 (30.1%)	2 (16.7%)	0.502
> 100,000	38 (45.8%)	2 (16.7%)	0.067
Leukocyte count			
< 4,000	35 (42.2%)	9 (75.0%)	0.033*
4,000 - 11,000	48 (57.8%)	3 (25.0%)	0.033*
> 11,000	0 (0.0%)	0 (0.0%)	-
Hematocrit (%)			
<30	12 (14.5)	1 (8.3%)	0.043*
30-35	45 (54.2)	3 (25.0%)	
>35	26 (31.3)	8 (66.7%)	
Serum albumin (g/dl)			
<3.0	7 (8.4%)	4 (33.3%)	0.009*
3.0-3.4	36 (43.4%)	6 (50.0%)	
≥3.5	40 (48.2%)	2 (16.7%)	
Total bilirubin (mg/dl)			
≤1.0	73 (88.0%)	8 (66.7%)	0.056
>1.0	10 (12.0%)	4 (33.3%)	

*p-value <0.05 – significant, **p-value <0.001 – highly significant

Table 5: Correlation between hepatic dysfunction and dengue severity.

Parameter	DF (n=83)	DHF/DSS (n=12)	P value
Elevated SGPT	40 (48.2%)	11 (91.7%)	0.005*
Mean SGPT (U/l)	47.8±35.2	101.3±67.9	<0.001**
Mean albumin	3.85	2.84	0.136

*p-value <0.05 – significant, **p-value <0.001 – highly significant.

Table 6: Length of hospital stay by dengue classification.

Dengue classification	Mean length of stay (days)±SD	P value
DF (n=83)	5.7±2.6	0.001*
DHF (n=11)	8.5±3.7	
DSS (n=1)	14.0	

*p-value <0.05 – significant, **p-value <0.001 – highly significant.

Table 7: Mean length of stay in dengue patients based on classification and SGPT Level.

	N	Mean length of stay (days)±SD	P value
Dengue classification			0.001*
DF (n=83)	83	5.7±2.6	
DHF (n=11)	11	8.5±3.7	
DSS (n=1)	1	14.0	
SGPT level (U/l)			0.007*
<40	44	5.3±2.1	
41-200	48	6.7±3.4	
>200	3	10.3±4.5	

*p-value <0.05 – significant, **p-value <0.001 – highly significant.

Table 8: Correlation between USG findings and hepatic dysfunction.

USG finding	Total cases	Cases with elevated SGPT (%)	P value
Normal	66	31 (47.0)	0.038*
Ascites	29	20 (69.0)	

*p-value <0.05 – significant, **p-value <0.001 – highly significant.

Table 9: Correlation between dengue seropositivity and disease severity.

Parameter	Seropositive (n=41)	Seronegative (n=54)	P value
Dengue classification			0.032*
DF	32 (78.0%)	51 (94.4%)	
DHF/DSS	9 (22.0%)	3 (5.6%)	
Hepatic dysfunction			
Elevated SGPT (>40 U/l)	26 (63.4%)	25 (46.3%)	0.092
Platelet count			0.041*
<100,000/µl	20 (48.8%)	17 (31.5%)	
≥100,000/µl	21 (51.2%)	37 (68.5%)	
Mean length of hospital stay (days)	7.2±3.5	5.6±2.8	

*p-value <0.05 – significant, **p-value <0.001 – highly significant

DISCUSSION

Our study provides comprehensive insights into hepatic dysfunction patterns in pediatric dengue infection and their correlation with disease severity. The predominance of cases in the 6–10 years age group (47.4%) aligns with findings from recent studies, which reported similar age distributions in their pediatric dengue cohorts.[8,9] The male preponderance (56.8%) observed in our study is consistent with patterns reported in multiple Asian studies, possibly reflecting greater outdoor exposure among male children.[10] Fever was a universal symptom in our cohort (100%), and abdominal pain affected 32.6% of cases, closely paralleling observations from comprehensive studies of pediatric dengue.[11] The progression to severe disease forms, including dengue haemorrhagic fever (DHF, 11.6%) and dengue shock syndrome (DSS, 1.1%), falls within the range reported in recent systematic reviews on dengue outcomes in Asian children.[12]

A key finding of our study is the significant correlation between hepatic dysfunction and disease severity. Elevated serum glutamate-pyruvate transaminase (SGPT) levels were observed in 53.5% of cases, with significantly higher rates in DHF/DSS compared to dengue fever (DF) (p=0.005), corroborating findings that identified liver enzyme elevation as an early marker of severe dengue.[13,14] The association between hypoalbuminemia and disease severity (p=0.009) further supports observations suggesting that serum albumin levels could serve as a prognostic indicator in pediatric dengue.[15] Additionally, thrombocytopenia (p=0.003) and leukopenia (p=0.033) were significantly associated with severe disease in our cohort, findings that align with studies highlighting these haematological markers as reliable predictors of dengue severity.[16,17]

Our study also observed a significant association between elevated SGPT levels and the duration of hospital stay (p=0.007), suggesting that early recognition of hepatic dysfunction could help predict hospitalization requirements and guide resource allocation. 13 This novel finding highlights the practical implications of monitoring liver function in pediatric dengue patients. Furthermore, the correlation between seropositive status and disease severity (p=0.032) aligns with recent immunological studies, emphasizing the potential role of immune status in disease progression. 14 Elevated hematocrit levels, significantly associated with severe disease (p=0.043), reinforce the current understanding of plasma leakage in severe dengue, as documented in pathophysiological studies.[17] Despite its strengths, our study has certain limitations. The single-center design and relatively small sample size for severe cases limit the generalizability of our findings.

Future research should focus on multicenter validation of these findings and explore the molecular mechanisms underlying liver dysfunction in dengue. Larger prospective studies are warranted to evaluate the potential role of early liver function monitoring in predicting disease progression and improving clinical outcomes.

CONCLUSION

This prospective study of pediatric dengue cases demonstrated that hepatic dysfunction significantly correlates with disease severity and outcomes. While fever was universal, hepatomegaly and petechial rashes were prominent in DHF/DSS cases. Liver involvement, manifesting as elevated enzymes, low albumin, jaundice, and coagulopathy, predicted disease severity and longer hospital stays.

Seropositive cases showed higher likelihood of developing severe dengue. The findings emphasize the importance of comprehensive monitoring of both clinical parameters (altered sensorium, hepatomegaly, rashes, bleeding) and laboratory markers (liver function, platelets, hematocrit, serology) for early recognition of severe cases and timely intervention. In endemic areas, the triad of fever, jaundice, and hepatomegaly should prompt consideration of dengue hepatitis and early tertiary care referral.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Mandal DK, Shah SP, Rathod HK, Vaghela D. A study on outcome of children with dengue infection and its clinical correlation with hepatidysfunction in a tertiary care hospital of Saurashtra. Int J Contemp Pediatr 2025;12:430-6.