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Original Research Article

Study of clinical profile and laboratory markers in early diagnosis of severe dengue in children

Suprith Amblihalli Srinivas*, Ramesh Pol

Department of Pediatrics, S. Nijalingappa Medical College, Bagalkot, Karnataka, India

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***Correspondence:**
Dr. Suprith Amblihalli Srinivas,
E-mail: suprithsupi20@gmail.com

ABSTRACT

Background: Dengue fever is a mosquito-borne viral disease that presents as asymptomatic or can clinically manifest with symptoms like hemorrhagic fever and shock. Alteration of various other hematological parameters includes leukopenia, thrombocytopenia, hematocrit changes, and liver enzyme alteration. this study aimed to investigate dengue patients' clinical profiles, laboratory parameters, and outcomes across different severity levels.
Methods: This is a prospective hospital-based study of 125 patients conducted at S. Nijalingappa medical college, Bagalkot over 18 months from August 2022 to February 2024. the study included 125 cases with serologically confirmed (NS1ag and/ IgM) between 1 to 14 years and categorized according to WHO classification.
Results: Out of 125 patients, 62 and 33 had dengue with and without warning signs, and 30 had severe dengue, 52% of cases had leucopenia, and thrombocytopenia was present in 105 (84%) cases with significantly higher in severity groups. Elevated SGOT 108 (86.4%) and SGPT 72 (57.6%) were commonly seen in disease severity groups. Liver dysfunction was observed in 86.4% of patients. All patients survived and improved with appropriate treatment.
Conclusions: This study highlights the importance of clinical and hematological parameters in the early recognition and management of severe dengue cases. Liver dysfunction was common in severe cases. Despite the varying severity, all patients in this cohort had favorable outcomes, emphasizing the effectiveness of proper management strategies.

Keywords: Clinical, Laboratory markers, Severe dengue

INTRODUCTION

Dengue fever, a mosquito-borne viral disease, has emerged as a major global health challenge, particularly in tropical and subtropical regions.[1] Caused either of the serotypes DENV-1, DENV-2, DENV-3, and DENV-4. The disease presents with wide spectrum of clinical manifestations ranging from mild febrile illness to severe life-threateningconditions. In recent years, there has been an alarming increase in the incidence of severe dengue cases, especially among children, raising significant concerns about the evolving nature of the disease and its impact on pediatric populations.[2]

The world health organization (WHO) estimates that 390 million dengue infections occur annually, with about 96 million manifesting clinically.[1] According to WHO in 2009 dengue was classified as dengue with or without warning signs or severe dengue. The clinical symptoms of dengue begin abruptly after an incubation period of 5-7 days (range 3-10 days) and have a 3-phase clinical course: febrile, critical, and recovery phase.

Lab diagnosis of dengue fever in children is crucial for confirming infection determining its severity and guiding appropriate treatment.[3] Viral detection by RT-PCR, serological tests (NS1 antigen, IgM/IgG by ELISA),

complete blood count (CBC-platelet count, hematocrit and white blood cell count) and liver function tests.

In severe cases, acute liver failure can occur, characterized by coagulopathy, encephalopathy, and multi-organ dysfunction. The severity of liver involvement has been associated with poorer outcomes in dengue patients, particularly in children.[4] Thus this study aimed to study the clinical and laboratory predictive markers based on the severity of dengue.

METHODS

Study place

This was prospective hospital-based study conducted in the department of pediatrics, S. Nijalingappa medical college, Bagalkot

Study duration

The study was conducted over a period of 18 months between August 2022 to February 2024.

Sample size

Total 125 cases were included in the study.

Inclusion criteria

Only serologically confirmed (NS1ag and IgM) primary dengue cases were included in the study between the age group of 1 year to 14 years were included in the study.

Exclusion criteria

Patients diagnosed with fever from other causes, those with preexisting chronic liver disease, and those in whom written consent was not obtained were excluded from the study.

Sampling method

To collect the required information from the study subjects the "direct interview method" of primary source of information technique was used. The patients were interviewed for collection of necessary information using the pre-tested, semi-structured questionnaire method.

Data collection

After obtaining approval and clearance from the institutional ethics committee, the patients fulfilling the inclusion criteria were enrolled for the study after obtaining informed consent. After clinical assessment, the patients were classified as dengue fever without warning signs, dengue fever with warning signs, and severe dengue. Laboratory investigations included CBC, WBC count, platelet count, hematocrit, SGOT, SGPT, and INR. Serial monitoring for clinical and hematological parameters was done. Cut-off values for laboratory tests are defined as follows: leucopenia (white blood cell count $<4000/mm^3$), thrombocytopenia (platelet count $<150\times103/mm^3$), elevated serum aspartate aminotransferase (AST>40U/l) or alanine aminotransferase (ALT>40U/l) were compared based on the severity of dengue.

Statistical analysis

Data were collected using a structured proforma and entered into a Microsoft excel spreadsheet. Statistical analysis was performed using SPSS version 25.0. Continuous variables were expressed as mean±standard deviation. Categorical variables were presented as frequencies and percentages. The study population was divided according to who classification. Comparisons between these groups were made using Student's t test or Mann-Whitney U test for continuous variables and chi-square test or Fisher's exact test for categorical variables, as appropriate. The correlation between liver enzyme levels and markers of disease severity (such as platelet count, hematocrit, SGOT, SGPT, PT, APTT, and INR levels) was assessed using Pearson's or Spearman's correlation coefficient.

RESULTS

A total of 396 children admitted with suspected dengue fever were screened for dengue NS1 antigen detection or positive dengue IgM by Mac ELISA. NS1 antigen and/or dengue Ig M was positive in 151 children. Twenty-six cases were excluded because patient attendees did not consent to the study (Figure 1). There were 34 (27.2%) children in the age groups of 0-5 years, 46 (36.8%) in the age group 6-10 years, and 45 (36%) children were more than 11-14 years. Maximum number of children presented with dengue with warning signs followed by without warning signs and sever dengue.

Fever was the chief complaint present in severe dengue 30 (100%) followed by abdominal pain or tenderness and loose stools accounting for 20 (66.7%) cases each, and bleeding manifestations present in 16 (53.3%) cases (Table 1) as compared to dengue with and without warning signs.

No significant differences in hemoglobin levels were found in all dengue cases, and leucopenia was present in 52% (65 cases) among them 46.7% (14 cases) were in severe dengue groups. Thrombocytopenia was present in 105 (84%) cases with a significantly higher incidence in severe dengue 86.6% (26 cases) and 50% (15 cases) showed platelet counts less than 50000. Normal PCV values (30-44%) are most common across all disease severity groups. No significant findings were found in prothrombin values and raised aPTT levels were found during the study accounting for 48% (61 cases) and raised INR levels were found in 57.6% (72 cases) out of

which 66.66% (20 cases) were found in severe groups. Elevated SGOT was found in 86.4% (108 cases) among those 36.4% (11 cases) showed SGOT levels >400 U/l and 83.3% (25 cases) showed raised SGOT in severe dengue groups and SGPT levels were raised in 57.6% (72 cases) and 16.7% (5 cases) found to have levels >400 U/l and 66.6% (20 cases) showed raised SGPT levels in severe dengue cases (Table 2).

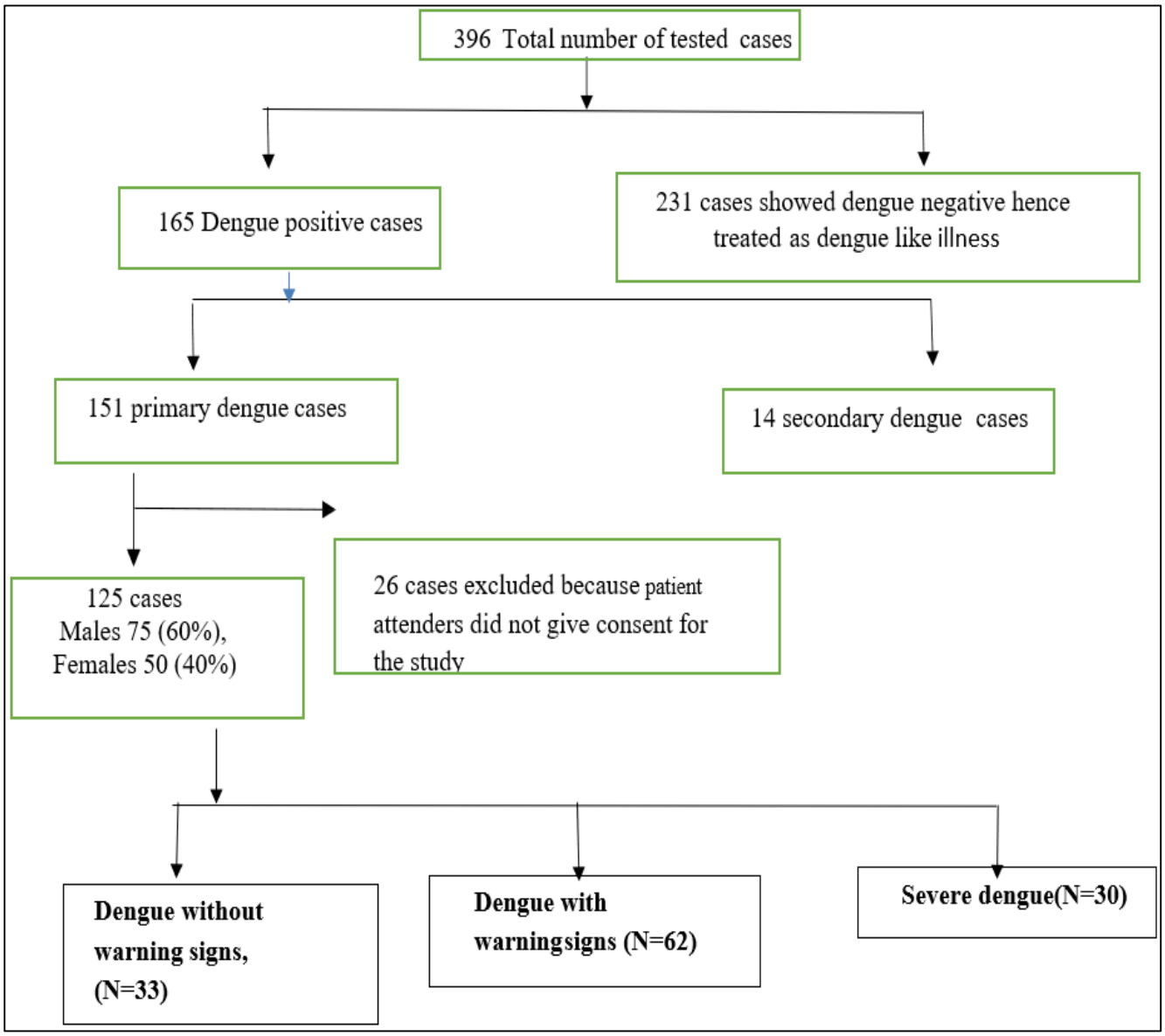

Figure 1: Dengue severity and proportion of children.

Table 1: Clinical manifestation with disease severity (n=125).

Clinical symptoms		Dengue without warning signs, (n=33)	Dengue with warning signs, (n=62)	Severe dengue, (n=30)	Total	P value
Fever		28 (87.5%)	60 (96.8%)	30 (100%)	118 (95.2%)	0.071
Abdominal pain		0	41 (66.1%)	20 (66.7%)	61 (49.2%)	<0.001
Loose stools		12 (36.4%)	17 (27.4%)	20 (66.7%)	49 (39.2%)	0.001
Fever with rashes		2 (6.7%)	8 (13.1%)	8 (26.7%)	18 (14.5%)	0.08
Vomiting		0	18 (29%)	6 (20%)	24 (19.4%)	0.003
Bleeding	Mucosal	0	2 (3.2%)	3 (10%)	5 (4%)	0.11
	Malena	0	7 (11.3%)	13 (43.3%)	20 (16%)	0.05
Body pain		0	4 (6.7%)	9 (30%)	13 (10.5%)	<0.001

Table 2: Association of CBC, PT, APTT, INR values, and SGOT, SGPT with disease severity, (n=125),

Parameters	Dengue without warning sings, (n=33)	Dengue with warning signs, (n=62)	Severe dengue, (n=30)	Total	P value
Anemia (<10 gm/dl)	3 (9.1%)	9 (14.5%)	5 (16.7%)	17 (13.6%)	0.703
WBC (/mm^3)					
<4000	13 (39.4%)	32 (51.6%)	14 (46.7%)	65 (52%)	0.704
4000-11000	17 (51.5%)	28 (45.2%)	14 (46.7%)	59 (47.2%)	
>11000	3 (9.1%)	2 (3.2%)	2 (6.7%)	7 (5.6%)	
Platelets					
<20000	0	3 (4.8%)	4 (13.3%)	7 (5.6%)	0.340
20000-50000	13 (39.4%)	20 (32.3%)	11 (36.7%)	44 (35.2%)	
50000-1,50,000	16 (48.5%)	27 (43.5%)	11 (36.7%)	54 (43.2%)	
>150,000	4 (12.1%)	12 (19.4%)	4 (13.3%)	20 (16%)	
PCV					
Low (>30%)	2 (6.5%)	4 (6.6%)	7 (23.3%)	13 (10.7%)	0.142
Normal (30-44%)	25 (80.6%)	51 (83.6%)	20 (66.7%)	96 (78.7%)	
High (>44%)	4 (12.9%)	6 (9.8%)	3 (10%)	13 (10.7%)	
Prothrombin time					
Normal (12-16 sec)	28 (84.8%)	49 (79%)	18 (60%)	95 (76%)	0.052
HIGH (>16 sec)	5 (15.2%)	13 (21%)	12 (40%)	30 (24%)	
APTT					
Normal (20-38 sec)	18 (54.5%)	33 (53.2%)	13 (43.3%)	64 (51.2%)	0.636
High (>38 sec)	15 (45.5%)	29 (46.8%)	17 (56.7%)	61 (48.8%)	
INR					
Normal (0.9-1.1)	23 (69.7%)	37 (59.7%)	11 936.7%)	71 (56.8%)	0.023
High (>1.1)	10 (30.3%)	25 (40.3%)	19 (63.3%)	54 (43.2%)	
SGOT					
Normal (<40)	3 (9.1%)	9 (14.5%)	9 (14.5%)	17 (13.6%)	<0.01
Raised (>40)	30 (90.90%)	53 (85.48%)	25 (83.3%)	108 (86.4%)	
SGPT					
Normal (<40)	19 (57.6%)	24 (38.7%)	10 (33.3%)	53 (42.4%)	<0.01
Raised (>40)	14 (42.2%)	38 (61.29%)	20 (66.66%)	72 (57.6%)	

DISCUSSION

Among the 125 pediatric patients with dengue, dengue with warning signs (49.6%), dengue without warning signs (26.4%), and severe dengue (24%) were seen. This distribution is comparable to a study by Jagadishkumar et al who reported 45.9% cases with warning signs, 37.7% without warning signs, and 16.4% severe cases.[4] The slight variation could be attributed to differences in local epidemiological factors.

Fever, abdominal pain, and loose stools were significantly associated with severe dengue. This is similar to the study done by Pongpan et al who identified abdominal pain and persistent vomiting as independent predictors of severe dengue.[5] These gastrointestinal symptoms may reflect both direct viral effects and the systemic inflammatory response in severe disease.

In our study, we found significant associations between dengue severity and platelet counts. This is also found in some studies that have reportedlower platelet counts in severe dengue. This aligns with findings by Jagadishkumar et al.[4]

Our study also examined coagulation parameters, finding a significant association between elevated INR (54) 43.2% and dengue severity. A study by Roy et al found abnormal PT/INR in 41.7% of cases.[6] Another study by Chhina et al observed deranged PT/INR in 15.5% (22/156) cases.[7] The coagulopathy in dengue is complex, involving both procoagulant and anticoagulant mechanisms, and may contribute to the risk of bleeding complications.

A key finding of our study was the high prevalence of raised SGOT and SGPT levels (86.4%) among dengue-infected children. This is consistent with several other studies that have reported hepatic involvement in dengue. For instance, Siddappa et al found raised SGOT and SGPT levels (86.4%) in 67.3% of pediatric dengue patients, while Selvan et al observed raised SGOT and SGPT levels (86.4%) in 30.6%.[8,9] Jagadishkumar et al reported raised levels of aspartate transaminase (AST) in

93%, alanine transaminase (ALT) in 78%, abnormal liver function tests in dengue infection have been reported by various workers, and the range.[4]

The high prevalence underscores the importance of monitoring liver function in dengue cases. In our cohort, elevated liver enzymes were significantly associated with dengue severity. Severe dengue cases showed higher rates of moderate to severe hepatitis, with 36.7% having SGOT >400 U/L and 36.7% having SGPT >200 U/L. This aligns with findings by Jagadishkumar et al who reported that AST and ALT levels were significantly higher in severe dengue compared to non-severe cases.[4] The hepatic enzymes were elevated significantly in DSS and DHF when compared to DF group which is similar to other studies.[8] Mean AST and ALT levels were more in severe dengue (268.40±188.34U/L and 134±104.61U/L) than DF with warning signs and DF without warning signs in Siddappa et al.[8] A similar finding was noted by Tambolkar et al.[10] The more pronounced elevation of SGOT compared to SGPT in our study, suggesting that SGOT might be a more sensitive indicator of dengue-associated liver injury. AST was higher than ALT in the present study, and similar observations were made by other studies.

Limitation

Need more cases of severe dengue for better correlation.

CONCLUSION

The study observed clinical symptoms like fever pain abdomen vomiting and bleeding are the commonest presentation in severe dengue and also observed dynamic changes in liver function tests and hematological parameters like platelet count, WBC, and INR throughout the illness, highlighting the importance of serial monitoring in dengue management. The strong association between liver enzyme elevations, clinical symptoms, and disease severity suggests that monitoring liver function and CBC could be valuable in predicting and managing dengue and severe dengue in pediatric patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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