Original Article

A Study on Correlation of Clinical Profile with Laboratory Investigations and Radiological Findings in Children Presenting with Dengue Fever

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Abstract

Background: Dengue fever is a major arboviral infection and an important public health concern in India, with children increasingly affected. Clinical presentation is highly variable, ranging from self-limiting febrile illness to severe disease with plasma leakage and organ involvement. Correlating clinical features with laboratory and radiological parameters can aid in early recognition of severe cases. **Objectives:** To study the correlation of clinical profile with laboratory investigations and radiological findings in children presenting with dengue fever, based on WHO (2009) classification. **Materials and Methods:** A prospective observational study was conducted in the Paediatric Ward, A tertiary health care centre, Tirupati, from December 2023 to July 2025. A total of 200 children aged 6 months–12 years with serologically confirmed dengue were enrolled. Detailed clinical evaluation, laboratory tests (CBC, LFT, RFT, coagulation profile, serology), and radiological assessments (chest X-ray, ultrasonography) were performed. Data were analyzed using SPSS v20.0, with ANOVA and Chi-square tests applied; $p < 0.05$ was considered statistically significant. **Results:** Of 200 children, 39% had dengue without warning signs (DWOWS), 47% with warning signs (DWWS), and 14% severe dengue (SD). Vomiting (74.5%), abdominal pain (55%), myalgia (53.5%), and bleeding manifestations (87%) were common. Significant predictors of severity included vomiting (p=0.013), convulsions (p=0.001), ascites (p=0.001), splenomegaly (p=0.001), thrombocytopenia (p=0.001), prolonged PT/APTT (p=0.001), elevated transaminases (AST p=0.009; ALT p=0.004), hypoalbuminemia (p=0.001), and pleural effusion (p=0.001). Dual serological positivity (NS1+IgM) was strongly associated with DWWS (74.4%, p=0.001). **Conclusion:** Dengue severity in children correlates strongly with clinical warning signs, thrombocytopenia, coagulation abnormalities, hepatic dysfunction, hypoalbuminemia, and radiological evidence of plasma leakage. Integrating these parameters with WHO criteria facilitates early identification of severe dengue and timely management, thereby reducing morbidity and mortality.

Keywords: Dengue fever, Children, Clinical profile, Laboratory investigations, Radiological findings, Thrombocytopenia, Hypoalbuminemia.

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Introduction

Dengue fever is the most important arboviral infection affecting humans and continues to be a major global public health problem.[1] Transmitted by Aedes aegypti and Aedes albopictus mosquitoes, dengue has emerged as a leading cause of morbidity and mortality in tropical and subtropical countries. The World Health Organization (WHO) has estimated that nearly 2.5 billion people live in areas at risk of dengue transmission, with approximately 50–100 million infections annually. India has witnessed a sharp rise in dengue epidemics over the last two decades, with a clear trend toward increasing incidence among children.[2-4]

The clinical spectrum of dengue ranges from mild febrile illness (dengue without warning signs) to more severe disease characterized by plasma leakage, bleeding manifestations, organ impairment, and shock (dengue with warning signs and severe dengue).[5-6] Early diagnosis and careful monitoring are essential to reduce complications and case fatality rates. Laboratory investigations including complete blood count, liver and renal function tests, and coagulation profiles together with radiological imaging such as chest radiography and ultrasonography, play a crucial role in identifying warning signs and predicting disease severity.[7-9]

Despite growing evidence, there remains variability in the correlation between clinical manifestations, laboratory parameters, and radiological findings across different geographical regions and age groups. In children, the disease often follows a more unpredictable course, underscoring the need for systematic evaluation. This study was therefore undertaken to analyze the correlation of clinical profiles with laboratory investigations and radiological findings in pediatric patients presenting with dengue fever, with the objective of identifying markers predictive of disease severity in the Indian setting.

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Materials and Methods

Study Area and Design: The present study was conducted in the Paediatric Ward, Department of Paediatrics, a tertiary health care centre, Tirupati after obtaining prior approval from the Institutional Ethical and Scientific Committee. It was designed as a prospective observational study and carried out between from December 2023 to July 2025.

Study Population: The study population comprised children between 6 months and 12 years of age who were admitted with clinical features suggestive of dengue illness.

Inclusion and Exclusion Criteria: Children were included if they were aged 6 months to 12 years, presented with clinical features consistent with dengue illness according to WHO 2009 criteria, and were confirmed serologically by dengue NS1 antigen positivity, dengue IgM antibody positivity, or by both NS1 antigen and IgM antibody positivity. Exclusion criteria consisted of children with febrile illness lasting more than two weeks, patients with any identified specific infection such as malaria, typhoid, or urinary tract infection, and children who tested negative for both dengue NS1 antigen and dengue IgM antibody.

Sample Size and Sampling: A simple random sampling technique was employed. The sample size was calculated using the formula $n = Z^2\alpha/2\ P\ (1\text{-}P)/d^2$, where $Z\alpha/2$ is the standard normal variate at 95% confidence (1.96), P represents the expected proportion in the population based on previous studies, and d denotes the absolute error or precision. On the basis of this calculation, the final sample size was determined to be 200.

Data Collection Procedure: A total of 200 children admitted with febrile illness of 2 to 7 days' duration and at least two dengue-like clinical features such as nausea or vomiting, rash, myalgia or arthralgia, a positive tourniquet test, or leukopenia were enrolled in the study. A detailed history was taken and a thorough clinical examination was performed for every patient using a structured proforma. Informed consent was obtained from the parent or legal guardian of each child. On admission, patients were classified according to WHO 2009 guidelines into dengue fever without warning signs (DF-WoWS), dengue fever with warning signs (DF-WS), and severe dengue (SD).

Laboratory Investigations: Laboratory evaluation included complete blood count, renal function tests, liver function tests, coagulation profile, and dengue serology. Blood samples collected in EDTA tubes were analyzed using a Mythic 18 autoanalyzer to measure total leukocyte count, hemoglobin, hematocrit, and platelet count. Renal function tests, including blood urea and serum creatinine, were performed on a fully automated biochemistry analyzer. Liver function tests, including serum SGOT (AST), SGPT (ALT), and albumin, were carried out from blood samples collected in plain bottles. Coagulation profile parameters, including prothrombin time (PT) and activated partial thromboplastin time (APTT), were determined by manual methods using appropriate reagents. Dengue NS1 antigen was detected within the first five days of illness using the Panbio Dengue Early ELISA kit (Cat. No. 01PE40), while dengue IgM antibodies were detected using the NIV DEN MAC ELISA Kit (Version 2.4), which has a reported sensitivity of 83.9–98.4% and a specificity of 100%.

Radiological Investigations: Radiological assessment was performed to evaluate features of plasma leakage. Chest X-ray was carried out to identify pleural effusion. Ultrasonography of the abdomen and chest was conducted using a Philips ultrasound machine (Model No. MCMD02AA, Type No. M2540-66500) to detect gallbladder wall thickening, acalculous cholecystitis, pleural effusion, ascites, and hepatomegaly.

Statistical Analysis: All data were compiled in Microsoft Excel and subsequently analyzed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Quantitative variables were expressed as mean ± standard deviation and compared between groups using ANOVA. Qualitative variables were expressed as frequency and percentage, and associations were tested using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 200 children met the inclusion criteria and were enrolled in the study. According to the WHO 2009 classification, 78 (39.0%) cases were categorized as dengue without warning signs (DWOWS), 94 (47.0%) as dengue with warning signs (DWWS), and 28 (14.0%) as severe dengue (SD).

Clinical Spectrum and Demographics

Of the 200 children, 109 (54.5%) were males and 91 (45.5%) were females, with a male-to-female ratio of 1.19:1. Gender distribution was similar across categories and did not differ significantly ($\chi^2 = 0.024$, $p = 0.988$) [Table 1].

Table 1: Clinical spectrum of dengue cases by gender distribution

Diagnosis	Female n (%)	Male n (%)	Frequency (n=200)	Percentage	P value
DWOWS (n=78)	35 (44.9%)	43 (55.1%)	78	39.0%	0.988
DWWS (n=94)	43 (45.7%)	51 (54.3%)	94	47.0%	
SD (n=28)	13 (46.4%)	15 (53.6%)	28	14.0%	
Total	91 (45.5%)	109 (54.5%)	200	100.0%	

The majority of patients belonged to the 8–12-year age group (115/200, 58.0%), followed by the 4–8-year group (29.0%), the 1–4-year group (13.0%), and those less than 1 year of age (<1.0%). Age distribution did not show a statistically significant association with disease category ($\chi^2 = 1.226$, $p = 0.976$) [Table 2].

Table 2: Age distribution of patients according to clinical spectrum

Diagnosis	<1 yr	1–4 yr	4–8 yr	8–12 yr	Total	P value
DWOWS (n=78)	0	10	23	45	78	0.976
DWWS (n=94)	1	13	26	54	94	
SD (n=28)	0	4	8	16	28	
Total (n=200)	1 (0.5%)	27 (13.5%)	57 (28.5%)	115 (57.5%)	200 (100%)	

Clinical Symptoms: Fever was a universal feature, present in all patients. Other common symptoms included vomiting in 74.5%, abdominal pain in 55.0%, myalgia in 53.5%, joint pain in 52.0%, retro-orbital pain in 39.4%, and headache in 34.0%. Convulsions were noted in 10.5% of children. On statistical analysis, vomiting ($p = 0.013$), diarrhea ($p = 0.002$), and convulsions ($p = 0.001$) were significantly associated with disease severity [Table 3].

Table 3: Analysis of symptomatology across clinical spectrum

Symptom	DWOWS (n=78)	DWWS (n=94)	SD (n=28)	Total (n=200)	P value
Fever	78 (100%)	94 (100%)	28 (100%)	200 (100%)	–
Abdominal pain	47 (60.3%)	50 (53.2%)	13 (46.4%)	110 (55.0%)	0.401
Vomiting	64 (82.0%)	61 (65.0%)	24 (86.0%)	149 (74.5%)	0.013*
Headache	20 (26.0%)	36 (38.2%)	12 (43.0%)	68 (34.0%)	0.124
Myalgia	45 (57.7%)	49 (52.1%)	13 (46.4%)	107 (53.5%)	0.553
Joint pain	35 (44.9%)	54 (57.4%)	15 (53.6%)	104 (52.0%)	0.255
Retro-orbital pain	31 (39.7%)	39 (41.5%)	9 (32.1%)	79 (39.4%)	0.673
Diarrhea	0 (0.0%)	0 (0.0%)	2 (7.1%)	2 (1.0%)	0.002*
Convulsions	0 (0.0%)	9 (9.6%)	12 (42.9%)	21 (10.5%)	0.001*

(*Statistically significant)

Clinical Signs and Vital Parameters

Hepatomegaly was the most frequent clinical sign, seen in 57.0% of patients, followed by facial puffiness in 49.0%, pedal edema in 47.0%, ascites in 22.0%, splenomegaly in 21.0%, and conjunctival hemorrhage in 18.0%. Significant associations were noted between severity and the presence of facial puffiness, pedal edema, ascites, splenomegaly, and conjunctival hemorrhage (all $p = 0.001$). Hepatomegaly was more common in severe cases, though the association did not reach statistical significance ($p = 0.064$) [Table 4]. Cutaneous bleeding manifestations were recorded in 173 (87.0%) cases, while mucosal bleeding occurred in 70.0% of children, most commonly as epistaxis (65.0%). Other bleeding manifestations included gum bleeding (3.0%) and hematemesis (2.0%). Among these, only epistaxis was significantly associated with severity ($\chi^2 = 91.48$, $p = 0.001$). Rashes were frequent and varied in phenotype, including flushing (40.5%), petechiae (20.5%), macular rash (17.0%), and ecchymosis (8.5%). Each rash subtype showed a progressive increase with severity and demonstrated significant associations with disease category ($p < 0.05$). The tourniquet test was positive in 42.0% of cases overall, with frequency rising from 28.2% in DWOWS to 42.6% in DWWS and 78.6% in SD ($p = 0.001$).

Table 4: Distribution of signs according to clinical spectrum

Sign	DWOWS (n=78)	DWWS (n=94)	SD (n=28)	Total (n=200)	P value
Hepatomegaly	37 (47.4%)	56 (59.6%)	20 (71.4%)	113 (57.0%)	0.064
Facial puffiness	10 (12.8%)	68 (72.3%)	19 (67.9%)	97 (49.0%)	0.001*
Pedal edema	14 (17.9%)	63 (67.0%)	17 (60.7%)	94 (47.0%)	0.001*
Ascites	1 (1.3%)	18 (19.1%)	24 (85.7%)	43 (22.0%)	0.001*
Splenomegaly	1 (1.3%)	26 (27.7%)	15 (53.6%)	42 (21.0%)	0.001*
Conjunctival hemorrhage	5 (6.4%)	22 (23.4%)	9 (32.1%)	36 (18.0%)	0.002*

(*Statistically significant)

Hematological Parameters: Hemoglobin concentration and hematocrit values did not differ significantly across the clinical categories ($p > 0.05$). The mean hemoglobin was 12.72 g/dL (range 6.5–18.9) and the mean hematocrit was 37.86% (range 18.7–54.2). Similarly, total leukocyte count showed no significant variation between groups ($p = 0.878$ by ANOVA), with a mean of 6014.5 cells/mm³ (range 1400–22,000). Leukopenia (<4000/mm³) was present in 36% of cases [Table 5]. In contrast, platelet counts demonstrated a strong correlation with severity ($\chi^2 = 37.55$, $p = 0.001$; ANOVA $p = 0.001$). The mean platelet count was 48,667/mm³ in DWOWS, 42,436/mm³ in DWWS, and 21,036/mm³ in SD. Severe thrombocytopenia (<20,000/mm³) was most frequent in the severe dengue group, while moderate thrombocytopenia (20,000–50,000/mm³) predominated in the other categories.

Coagulation Profile: Coagulation abnormalities were common and associated with disease severity. Prothrombin time (PT) was prolonged in 46.2% of DWOWS, 81.9% of DWWS, and 78.6% of SD, with significant intergroup differences ($\chi^2 = 26.66$, $p = 0.001$). The mean PT was 16.77 seconds (range 11.1–54.0). Activated partial thromboplastin time (APTT) was deranged in 1.3% of DWOWS, 58.5% of DWWS, and 64.2% of SD, with both Chi-square ($\chi^2 = 68.52$, $p = 0.001$) and ANOVA ($p = 0.039$) showing significance. The mean APTT was 37.63 seconds [Table 5].

Table-5: Haematological, Renal, and Rash Parameters According to Clinical Spectrum

Parameter	Category	DWOWS (n=78)	DWWS (n=94)	SD (n=28)	p value
Skin Rashes	Flushing	22 (28.2%)	40 (42.5%)	19 (67.9%)	0.001*
	Petechiae	0 (0.0%)	24 (25.5%)	17 (60.7%)	0.001*
	Macular rash	0 (0.0%)	21 (22.3%)	13 (46.4%)	0.001*
	Ecchymosis	0 (0.0%)	6 (6.3%)	11 (39.2%)	0.001*
Tourniquet Test	Positive	22 (28.2%)	40 (42.6%)	22 (78.6%)	0.001*
	Negative	56 (71.8%)	54 (57.4%)	6 (21.4%)	
Haemoglobin (PCV %)	≤45	74 (94.9%)	85 (90.4%)	23 (82.1%)	0.126
	>45	4 (5.1%)	9 (9.6%)	5 (17.9%)	
Total Leukocyte Count (cells/mm³)	<4000	22 (28.2%)	38 (40.4%)	12 (42.9%)	0.172
	4000–11000	51 (65.4%)	47 (50.0%)	12 (42.9%)	
	>11000	5 (6.4%)	9 (9.6%)	4 (14.3%)	
Platelet Count (cells/mm³)	<20,000	8 (10.3%)	25 (26.6%)	17 (60.7%)	0.001*
	20,000–50,000	36 (46.2%)	47 (50.0%)	9 (32.1%)	
	50,000–100,000	34 (43.6%)	20 (21.3%)	2 (7.1%)	
	>100,000	0 (0.0%)	2 (2.1%)	0 (0.0%)	
Prothrombin Time (s)	26–36	77 (98.7%)	39 (41.5%)	10 (35.8%)	0.001*
	>36	1 (1.3%)	55 (58.5%)	18 (64.2%)	
Blood Urea (mg/dL)	5–18	13 (16.7%)	11 (11.7%)	3 (10.7%)	0.572
	>18	65 (83.3%)	83 (88.3%)	25 (89.3%)	
Serum Creatinine (mg/dL)	0.3–0.7	54 (69.2%)	73 (77.7%)	19 (67.9%)	0.373
	>0.7	24 (30.8%)	21 (22.3%)	9 (32.1%)	

Renal Function: Elevated blood urea levels (>18 mg/dL) were observed in most patients, but differences across severity groups were not statistically significant ($\chi^2 = 1.11$, p = 0.572). Serum creatinine levels were also not significantly different across categories by Chi-square (p = 0.373). However, ANOVA indicated a modest but statistically significant rise in creatinine in severe dengue (0.76 ± 0.33 mg/dL) compared with DWOWS (0.67 ± 0.15) and DWWS (0.64 ± 0.15) (p = 0.011) [Table 6].

Liver Function and Serum Albumin: Transaminase levels were elevated in the majority of cases and correlated with disease severity. The mean AST (SGOT) level increased from 111.9 ± 99.2 IU/L in DWOWS to 183.3 ± 177.6 in DWWS and 194.8 ± 245.6 in SD (p = 0.009). ALT (SGPT) levels showed a similar pattern, with means of 62.1 ± 55.2, 126.7 ± 154.9, and 107.6 ± 163.3 IU/L respectively (p = 0.004). Hypoalbuminemia (<3.4 g/dL) was highly prevalent (72% overall) and was strongly associated with severity: 55.1% in DWOWS, 80.9% in DWWS, and 89.3% in SD (p = 0.001). Mean serum albumin declined significantly with increasing severity (p = 0.001). Electrolyte values (sodium, potassium, and chloride) did not differ significantly between groups [Table 6].

Table 6: Liver Function and Serum Electrolytes According to Clinical Spectrum

Parameter	DWOWS (n=78)	DWWS (n=94)	SD (n=28)	Total (n=200)	p value
AST (SGOT), IU/L	111.9 ± 99.2	183.3 ± 177.6	194.8 ± 245.6	156.8 ± 167.4	0.009*
ALT (SGPT), IU/L	62.1 ± 55.2	126.7 ± 154.9	107.6 ± 163.3	98.8 ± 130.0	0.004*
Serum albumin (g/dL)	3.32 ± 0.53	3.02 ± 0.69	2.77 ± 0.65	3.10 ± 0.66	0.001*
Serum sodium (mEq/L)	138.2 ± 4.4	135.2 ± 13.8	137.4 ± 5.3	136.7 ± 10.1	0.143
Serum potassium (mEq/L)	4.34 ± 0.60	4.67 ± 4.06	3.99 ± 0.66	4.45 ± 2.81	0.487
Serum chloride (mEq/L)	101.8 ± 3.7	99.6 ± 11.1	99.9 ± 5.0	100.5 ± 8.2	0.211

**Statistically significant (p < 0.05).*

Table-7: Dengue Serology According to Clinical Spectrum

Test Component	Result	DWOWS (n=78)	DWWS (n=94)	SD (n=28)	p value
NS1 Antigen	Positive	42 (53.8%)	37 (39.4%)	9 (32.1%)	0.122
	Negative	36 (46.2%)	57 (60.6%)	19 (67.9%)	–
IgM Antibody	Positive	31 (39.7%)	28 (29.8%)	14 (50.0%)	0.064
	Negative	47 (60.3%)	66 (70.2%)	14 (50.0%)	–
Dual positivity (NS1 + IgM)	Positive	5 (6.4%)	29 (74.4%)	5 (17.9%)	0.001*
	Negative	73 (93.6%)	65 (69.1%)	23 (82.1%)	–

*Statistically significant (p < 0.05).

Radiological Findings: Chest radiography revealed pleural effusion in 83 (42.0%) children, with a marked increase in prevalence across categories: 10.3% in DWOWS, 51.1% in DWWS, and 96.4% in SD (p = 0.001). Ultrasonography was

abnormal in 161 (80.5%) cases, most commonly showing hepatomegaly (57.0%), pleural effusion (42.0%), gallbladder wall edema (37.0%), ascites (22.0%), and splenomegaly (21.0%). Acalculous cholecystitis was noted in 3.5%. All ultrasound abnormalities except hepatomegaly were significantly associated with severity ($p < 0.05$) [Figure 1 and 2].

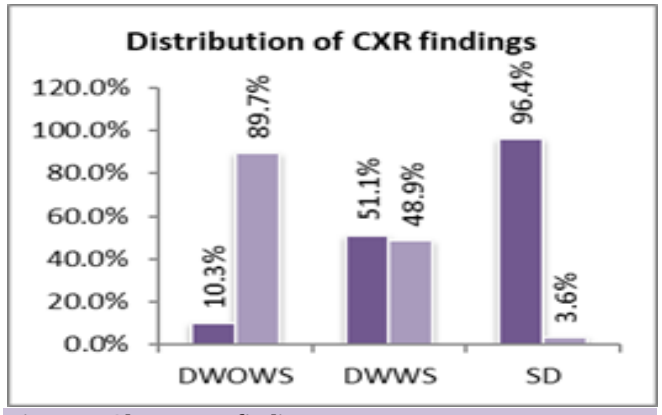

Figure 1: Chest X ray findings

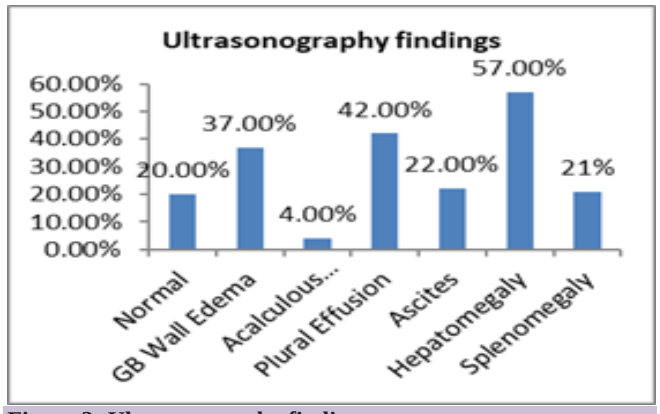

Figure 2: Ultrasonography findings

Serological Findings

NS1 antigen was positive in 88 (44.0%) cases, IgM antibody in 73 (37.0%), and both NS1 and IgM in 39 (19.0%). By clinical spectrum, NS1 positivity was highest in DWOWS (53.8%) but did not differ significantly across categories ($p = 0.122$). IgM positivity trended higher in severe dengue (50.0%) compared with DWOWS (39.7%) and DWWS (29.8%) ($p = 0.064$). Dual positivity was significantly associated with DWWS (74.4%) compared with DWOWS (6.4%) and SD (17.9%) ($p = 0.001$).

Discussion

Dengue fever is the most important arboviral infection affecting humans and is now recognized as a major public health challenge in India, with children constituting a particularly vulnerable group. While classical dengue without warning signs (DWOWS) is usually self-limiting, the more severe forms dengue with warning signs (DWWS) and severe dengue (SD) are associated with increased morbidity and mortality. The early identification of warning signs and careful monitoring are, therefore, critical to preventing life-threatening complications.

Incidence and Demographics: In the present study, 39% of children were classified as DWOWS, 47% as DWWS, and 14% as SD according to WHO 2009 criteria. These findings closely resemble the results of Arunagirinathan et al,[10] who reported 38%, 52%, and 10%, respectively. By contrast, Kale et al,[11] observed a disproportionately high proportion of DWWS cases (85.3%), underscoring the regional variability of dengue presentations across India.

Children between 4 and 12 years were most affected (87%), confirming that the school-age population remains the most susceptible group. The youngest patient in the study was 11 months old. These results are consistent with the reports of Eregowda et al. (Bengaluru, 2013),[12] and Narayanan et al. (Chennai, 2002),[13] though the incidence in our cohort was comparatively higher. A slight male predominance (M:F ratio 1.19:1) was noted, consistent with the observations of Gurdeep et al,[14] and Sajid et al,[15] and has been attributed to increased outdoor exposure and a higher risk of mosquito bites among boys.

Clinical Features: Fever was a universal finding (100%). Other common symptoms included vomiting (74.5%), abdominal pain (55%), joint pain (52%), retro-orbital pain (39.4%), and headache (34%). These results are broadly in agreement with Kale et al,[11] though some studies have reported a lower prevalence of abdominal pain and headache. Our findings reaffirm that gastrointestinal and musculoskeletal symptoms are frequent in pediatric dengue, in line with WHO's clinical spectrum.

Bleeding manifestations were common. Cutaneous bleeding occurred in 87% of children, while mucosal bleeding was observed in 70%, most frequently as epistaxis (65%). Epistaxis showed a significant correlation with severity ($p = 0.001$), consistent with the findings of Anuradha et al.[16] By contrast, Kumar et al,[17] reported hematemesis as the more common mucosal manifestation.

Hypotension was detected in 31% of patients, increasing sharply to 75% in severe dengue compared with only 7.7% in DWOWS. This establishes hypotension as a strong clinical predictor of disease severity. The tourniquet (Hess) test was positive in 42% of children, a result similar to Kabra et al.[18] However, the test has shown variable reliability in different studies, with rates as high as 83.9% reported by Nimmannitya et al.[19] Our findings, consistent with Gomber et al,[20] suggest that the tourniquet test alone is insufficient as a diagnostic marker.

Hematological and Coagulation Parameters: Hemoglobin and hematocrit levels showed no significant correlation with severity. The mean hemoglobin was 12.7 g/dL, and the mean hematocrit was 37.9%, a pattern also noted by Narayanan et al.[13] Leukopenia was present in 36% of our patients, comparable with the 52.8% reported by Nazish Butt et al. (Pakistan, 2011).[21]

Thrombocytopenia was a near-universal feature. Platelet counts <100,000/mm³ were observed in almost all children, and severe thrombocytopenia (<20,000/mm³) was strongly associated with severe dengue. This is in line with the studies of Gomber et al. [20] and Narayanan et al.[13] Prolonged PT (67.5%) and APTT (37%) were significantly associated with severity, indicating

coagulation abnormalities likely related to hepatic dysfunction and disseminated intravascular coagulation (DIC). These findings are supported by Larreal et al.[22]

Biochemical Parameters: Both AST and ALT were elevated, with AST predominating, which is consistent with the results of Petdachai et al,[23] and Jagadish Kumar et al,[24] Hypoalbuminemia was observed in 72% of children and was significantly correlated with severity. This supports the observations of Itha et al,[25] and highlights its clinical value as an indicator of plasma leakage and disease progression.

Radiological Findings: Radiological evaluation played a crucial role in identifying plasma leakage. Pleural effusion was present in 42% of children and correlated strongly with disease severity. This finding aligns with WHO's emphasis on right-sided pleural effusion as a hallmark of plasma leakage and is consistent with the results of Jagadish Kumar et al,[24] and Venkata Sai et al.[26] Gallbladder wall edema, ascites, and splenomegaly also showed strong associations with severity, further emphasizing the utility of ultrasonography in early detection of complications.

Serological Profile: NS1 antigen positivity was noted in 44%, IgM antibody in 37%, and both in 19%. Dual positivity was significantly associated with the DWWS category (74.4%, p = 0.001), a finding that concurs with Kale et al.[11] While NS1 antigen was most common in DWOWS, IgM antibody was more frequently detected in severe dengue, suggesting dynamic serological changes with disease progression.

Summary of Key Findings: In summary, our study confirmed that dengue severity correlated strongly with bleeding manifestations, thrombocytopenia, prolonged PT and APTT, elevated transaminases, hypoalbuminemia, and radiological markers of plasma leakage such as pleural effusion and gallbladder wall edema. These results reinforce the clinical utility of the WHO 2009 classification and underscore the need for early recognition of warning signs in order to improve pediatric outcomes.

Conclusion

This prospective observational study of 200 pediatric dengue cases provides important insights into the relationship between clinical manifestations, laboratory derangements, and radiological findings. The majority of children were classified as dengue with warning signs (47%), followed by dengue without warning signs (39%) and severe dengue (14%). The most affected age group was 8–12 years, with a slight male predominance. Predictors of severity included vomiting, diarrhea, convulsions, bleeding manifestations (especially epistaxis), facial puffiness, pedal edema, ascites, splenomegaly, and conjunctival hemorrhage. Among laboratory parameters, thrombocytopenia, prolonged PT and APTT, elevated transaminases, and hypoalbuminemia were strongly associated with severe disease. Radiologically, pleural effusion, gallbladder wall edema, ascites, and splenomegaly correlated significantly with severity, confirming their utility as non-invasive markers of plasma leakage.

NS1 antigen and IgM antibody positivity varied across categories, but dual positivity was significantly linked with dengue with warning signs. These findings collectively reinforce the WHO 2009 classification and highlight the importance of integrating clinical evaluation with targeted laboratory and radiological investigations to stratify risk, ensure early recognition of complications, and improve outcomes in pediatric dengue.

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Conflicts of interest

There are no conflicts of interest.

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