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Original Research Article

A PROSPECTIVE OBSERVATIONAL STUDY IN CHILDREN BETWEEN AGE GROUP OF 1 MONTH TO 12 YEARS IN MEASUREMENT OF SERUM FERRITIN, LIVER ENZYMES -SERUM GLUTAMIC OXALOACETIC TRANSAMINASE (SGOT), SERUM GLUTAMIC PYRUVIC TRANSAMINASE (SGPT)AS A PROGNOSTIC INDICATOR OF SEVERE DENGUE IN CHILDREN ADMITTED IN TERTIARY CARE CENTRE

Sakthipriya A.R[1], V.Vahini[2], Karthikeyan C[1]

[1]Department of Paediatrics, Coimbatore Medical College, Coimbatore, Tamilnadu, India
[2]Assistant Professor, Department of Paediatrics, Coimbatore Medical College, Coimbatore, Tamilnadu, India

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Corresponding Author:
Dr. Sakthipriya A.R,
Department of Paediatrics, Coimbatore Medical College, Coimbatore, Tamilnadu, India.
Email: sakthipriya2711@gmail.com

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ABSTRACT

Background: Dengue is a major pediatric public health problem in tropical countries, with clinical presentation ranging from dengue with warning signs to severe dengue with shock and organ dysfunction. Early identification of children at risk for severe dengue is essential for timely monitoring and management. Serum ferritin and liver enzymes such as serum glutamic oxaloacetic transaminase (SGOT/AST) and serum glutamic pyruvic transaminase (SGPT/ALT) may serve as useful prognostic biomarkers, but their serial evaluation in hospitalized children remains clinically relevant. The aim is to assess the prognostic value of serum ferritin, SGOT, and SGPT in predicting severe dengue among children aged 1 month to 12 years admitted to a tertiary care centre.

Materials and Methods: This was a prospective observational study conducted over 1 year in a tertiary care centre, including 86 children aged 1 month to 12 years with dengue (as per WHO 2023 criteria) and/or NS1Ag/IgM positivity. Children with severe anemia, alternate causes of thrombocytopenia, other confirmed febrile serologies, and chronic transfusion-dependent hemolytic anemia were excluded. Clinical history, examination findings, and investigations including CBC, ferritin, liver function tests, serum albumin, IgM dengue, USG abdomen, and chest X-ray were recorded. Serum ferritin, SGOT, SGPT, and albumin were measured on Day 1 and Day 3 of admission. Data were analyzed to compare dengue with warning signs (DWS) and severe dengue, and ROC analysis was performed to determine diagnostic cut-offs.

Results: Of 86 children, 66 (76.7%) had DWS and 20 (23.3%) had severe dengue; no child had dengue without warning signs. DSS constituted 18 (20.93%) and DHF 2 (2.33%) cases. Altered sensorium (p=0.001), tender hepatomegaly (p=0.027), and clinical fluid accumulation (p=0.022) were significantly associated with severe dengue. Mean ferritin levels were significantly higher in severe dengue on Day 1 (719.46 ± 245.13 vs 378.66 ± 163.53 ng/mL; p=0.001) and Day 3 (567.71 ± 148.95 vs 433.29 ± 135.72 ng/mL; p=0.006). SGOT and SGPT were also significantly elevated in severe dengue on both days ($p<0.05$). On ROC analysis, Day 1 ferritin showed the best performance (cut-off 536 ng/mL, sensitivity 95.0%, specificity 78.5%, Youden index 0.735), outperforming SGOT, SGPT, and albumin.

Conclusion: Serum ferritin is a strong prognostic biomarker for severe dengue in children, with SGOT and SGPT providing additional supportive value. Serial measurement of ferritin and liver enzymes, along with clinical assessment, can help in early risk stratification and close monitoring of pediatric dengue cases in tertiary care settings.
Keywords: Dengue; Severe dengue; Serum ferritin; SGOT; SGPT.

INTRODUCTION

Dengue is one of the most important arboviral illnesses affecting children in tropical and subtropical regions, with seasonal surges that place a major burden on emergency services and pediatric wards. The clinical spectrum ranges from a self-limited febrile illness to life-threatening disease characterized by plasma leakage, bleeding, shock, and organ dysfunction. The challenge for clinicians is that deterioration often occurs around the time of defervescence, when fever subsides and families may assume recovery is beginning. Because severe manifestations can evolve rapidly, early recognition of children at risk is critical to reduce morbidity and mortality through timely fluid management, close monitoring, and escalation of supportive care. Standard clinical guidance emphasizes identification of warning signs such as persistent vomiting, abdominal pain or tenderness, lethargy/restlessness, clinical fluid accumulation, mucosal bleeding, and hepatomegaly, which indicate higher risk of progression and the need for careful observation and repeated assessment rather than single-point evaluation.[1] In hospitalized pediatric populations, the proportion of dengue with warning signs and severe dengue is often higher than in community cohorts because referral patterns enrich for clinically significant disease. Modern case definitions also focus attention on plasma leakage and organ involvement rather than bleeding alone, allowing clinicians to triage based on evolving physiology. National and programmatic dengue management guidance used in many tertiary-care settings reinforces structured clinical classification and serial monitoring, particularly during the critical phase, when shock and respiratory compromise from fluid shifts may occur even in the absence of overt hemorrhage. This approach highlights the importance of integrating bedside findings with objective markers that can indicate systemic inflammation, hepatic involvement, and early plasma leakage, especially when typical symptoms are common across severity categories and may not individually discriminate severe disease at presentation.[2] While clinical assessment remains central, there is increasing interest in biomarkers that can help predict severe dengue earlier and more reliably than conventional parameters alone. The first 3–4 days of illness are particularly important because decisions about admission, monitoring intensity, and follow-up are often made during this period. Evidence syntheses focusing on early biomarkers measured within the initial febrile window show that many candidate markers reflect endothelial activation, immune dysregulation, and inflammatory amplification—processes closely linked to plasma leakage and organ impairment. However, a key limitation across outbreaks and regions is that no single marker perfectly predicts which child will progress, and performance depends on timing of sampling, baseline risk in the population, and the severity distribution of admitted cases. Therefore, practical markers that are widely available, affordable, and repeatable—such as ferritin and transaminases—remain attractive options for tertiary centers managing high case loads.[3] Serum ferritin, traditionally viewed as an iron-storage protein, also acts as an acute phase reactant and rises markedly with systemic inflammation. In dengue, higher ferritin levels are thought to reflect intense immune activation, macrophage stimulation, and cytokine-mediated injury, which are mechanistically linked to vascular permeability and organ dysfunction. Importantly, ferritin can rise early and may remain elevated during the critical phase, making it suitable for serial measurement to track inflammatory trajectory rather than relying on a single value. Recent clinical evidence supports ferritin's association with severe dengue phenotypes and suggests that specific thresholds can help stratify risk, especially when interpreted alongside clinical warning signs and hemodynamic status. In pediatric cohorts, ferritin has been shown to differentiate more severe disease categories and provide prognostic information, reinforcing its potential utility as a practical early marker in hospital settings where rapid triage decisions are required.[4] Hepatic involvement is another frequent feature of dengue in children and may manifest as hepatomegaly, tenderness, transaminase elevation, jaundice, or—in severe cases—acute liver failure as part of multisystem dysfunction. Transaminase elevation in dengue is commonly characterized by a rise in SGOT/AST that may exceed SGPT/ALT, reflecting contributions from hepatic and extrahepatic sources of AST during systemic illness. Several pediatric datasets indicate that higher aminotransferase levels correlate with more severe clinical courses, and that liver enzyme patterns can help identify children at increased risk for complications, including shock and organ impairment. Because SGOT and SGPT are routinely available in most tertiary-care laboratories, they offer a feasible way to supplement clinical assessment with objective evidence of organ involvement, and their serial trends may be particularly informative during the transition from febrile to critical phase.[5] Beyond routine transaminase elevation, defining clinically meaningful cut-offs has practical value for severity prediction and escalation planning. Some pediatric

research has evaluated higher aminotransferase thresholds as markers of severe disease, supporting the concept that marked enzyme elevation may indicate significant hepatic injury or systemic severity. Such validation work is relevant for tertiary care where clinicians must rapidly distinguish children who can be safely managed with standard monitoring from those who require closer observation, early critical care preparedness, or intensified evaluation for complications. In this context, combining inflammatory markers such as ferritin with organ-involvement markers such as SGOT/SGPT may improve prognostic precision compared with relying solely on platelet count or hematocrit trends, which are common abnormalities in hospitalized dengue and may not always differentiate severity at first assessment. Serum albumin is also clinically relevant in dengue because falling albumin can reflect plasma leakage and capillary permeability, hallmark mechanisms underlying shock and third-space fluid accumulation. Although albumin is influenced by baseline nutrition, hydration, and comorbid illness, trends toward hypoalbuminemia during the critical phase can support suspicion of significant leakage, especially when paired with clinical fluid accumulation or rising hematocrit with unstable hemodynamics. Evidence synthesis indicates that hypoalbuminemia is associated with severe dengue and adverse outcomes, suggesting that albumin may contribute to risk stratification—particularly when interpreted dynamically and in combination with other markers rather than as an isolated admission value.[6]

MATERIALS AND METHODS

This study was conducted as a prospective observational study over a period of 1 year at a tertiary care centre. The study population included children aged 1 month to 12 years who were admitted with clinical features, signs, and symptoms suggestive of dengue, in accordance with WHO (2023) guidelines. A total sample size of 86 children was included. Children were enrolled if they had fever with thrombocytopenia and clinical features of dengue (dengue without warning signs / dengue with warning signs / severe dengue) as per WHO (2023), or if they had fever with NS1 antigen positivity and/or IgM dengue positivity. Children were excluded if they had severe anemia (Hb <7 g/dL), thrombocytopenia with an alternate confirmed diagnosis, fever with other serology positivity (such as scrub typhus, enteric fever, or influenza), or hemolytic anemia (e.g., thalassemia) requiring chronic blood transfusions.

Study Procedure and Clinical Evaluation: After obtaining approval from the Institutional Ethics Committee (IEC), the study protocol was formulated and implemented. All children fulfilling the inclusion criteria were assessed at admission and enrolled in the study after obtaining informed consent from parents/guardians. A detailed clinical history was recorded, and findings were documented in a structured case proforma for each participant. Initial clinical assessment and ongoing monitoring were performed for all enrolled children. All patients were managed according to WHO 2023 dengue management guidelines and institutional protocol, and children with abnormal laboratory parameters were closely observed for progression to severe dengue and associated complications.

Laboratory Investigations and Follow-up: Routine investigations included complete blood count (CBC) and other relevant tests such as liver function tests (including liver enzymes SGOT/AST and SGPT/ALT), serum albumin, serum ferritin, IgM dengue, ultrasonography (USG) abdomen, and chest X-ray. Serum ferritin, liver enzymes (SGOT and SGPT), and serum albumin were measured on Day 1 of admission and Day 3 of admission. The collected data were analyzed by comparing children with normal laboratory values and those with elevated values in relation to progression to severe dengue and its complications.

Statistical Analysis: Statistical analysis was performed to determine whether these laboratory parameters could serve as prognostic indicators of severe dengue. In particular, abnormal serum ferritin values were further analyzed to identify an optimal cut-off value with high sensitivity, specificity, and positive predictive value for predicting severe dengue.

RESULTS

[Table 1] Distribution of dengue severity (WHO 2023 classification) among enrolled children (N = 86)

[Table 1] shows the overall severity profile of dengue among the 86 enrolled children based on WHO 2023 classification. A majority of children, 66 out of 86 (76.7%), were classified as dengue with warning signs (DWS), while 20 children (23.3%) had severe dengue. Notably, no child (0%) was classified as dengue without warning signs. This pattern suggests that the study population predominantly consisted of relatively sicker children, which is expected in a tertiary care referral centre where patients with warning signs and severe manifestations are more likely to be admitted for advanced management. The absence of uncomplicated dengue cases indicates referral bias toward more clinically significant disease.

[Table 2] Clinical severity subtypes among study participants (N = 86)

[Table 2] further sub-classifies the enrolled children into clinical severity subtypes. DWS accounted for 66 children (76.74%), forming the largest group. Among severe dengue cases, dengue shock syndrome (DSS) constituted the major proportion with 18 children (20.93%), whereas dengue hemorrhagic fever (DHF) was seen in only 2 children (2.33%). These findings indicate that among severe presentations in this

cohort, circulatory compromise/shock was the dominant severe phenotype rather than classical hemorrhagic manifestations. Clinically, this is important because it highlights the need for close hemodynamic monitoring and timely fluid resuscitation in admitted pediatric dengue patients.

[Table 3] Baseline demographic distribution according to dengue severity

[Table 3] presents baseline demographic characteristics (gender and age group) in relation to dengue severity. With respect to gender, 48 children were male and 38 were female. Severe dengue occurred in 11/48 males (22.9%) and 9/38 females (23.7%), showing nearly identical proportions across sexes. The p value of 0.933 indicates that there was no statistically significant association between gender and severity of dengue in this study. Thus, both boys and girls had a comparable risk of progressing to severe disease in this cohort.

In terms of age distribution, the majority of cases belonged to the 5–12 years age group (69/86, 80.2%), followed by 3–5 years (9/86), 1–3 years (7/86), and <1 year (1/86). Severe dengue was observed across age groups, with the highest absolute number seen in the 5–12 years group (17 cases) because this age group constituted the largest share of admissions. However, the p value of 0.660 shows no statistically significant association between age group and dengue severity. Therefore, although older children formed the bulk of admitted cases, age group itself did not significantly predict progression to severe dengue in this sample.

[Table 4] Distribution of clinical features and key examination/laboratory signs by severity

[Table 4] compares symptoms at presentation and important clinical/laboratory signs between children with DWS and severe dengue. Among symptoms, abdominal pain (98.8%), decreased oral intake (97.7%), lethargy (89.5%), and vomiting (84.8%) were extremely common in the overall cohort, indicating that these warning features were highly prevalent among hospitalized children. However, these symptoms did not show statistically significant differences between DWS and severe dengue (all p values >0.05), meaning they were common in both groups and therefore less useful alone in discriminating severity.

A notable exception was altered sensorium, which was present in 17 children (19.8%) overall and showed a strong association with severe dengue (10/20 severe vs 7/66 DWS; p = 0.001). This indicates that altered sensorium is an important red-flag clinical marker in pediatric dengue and may signify severe systemic involvement, shock, encephalopathy, or metabolic derangement. Decreased urine output was more frequent in severe dengue (16/20) than in DWS (37/66), and its p value (0.054) approached significance, suggesting a possible trend toward association with severity that may become significant in a larger sample.

Among examination/laboratory signs, thrombocytopenia (94.2%) and raised hematocrit (82.6%) were very common but did not differ significantly between severity groups (p = 0.361 and 0.743 respectively), likely because these are common features in hospitalized dengue overall. In contrast, tender hepatomegaly was significantly associated with severe dengue (19/20 severe vs 47/66 DWS; p = 0.027), suggesting hepatic involvement may be more prominent in severe disease. Clinical fluid accumulation was also significantly associated with severity (14/20 severe vs 27/66 DWS; p = 0.022), supporting the role of plasma leakage as a hallmark of severe dengue. Although pleural effusion, ascites, and pulmonary edema were seen more often proportionally in severe dengue, these did not reach statistical significance in this dataset, possibly due to limited sample size.

[Table 5] Comparison of serial laboratory parameters between DWS and severe dengue

[Table 5] is central to the study objective and compares mean laboratory values (Day 1 and Day 3) between DWS and severe dengue groups. Mean age was similar in both groups (7.95 ± 2.59 vs 8.15 ± 2.58 years; p = 0.769), confirming that age did not confound laboratory comparisons significantly.

Serum ferritin levels were markedly higher in severe dengue than DWS on both Day 1 (719.46 ± 245.13 vs 378.66 ± 163.53 ng/mL; p = 0.001) and Day 3 (567.71 ± 148.95 vs 433.29 ± 135.72 ng/mL; p = 0.006). This demonstrates a significant association between elevated ferritin and severe dengue, supporting ferritin as a useful inflammatory/prognostic biomarker in pediatric dengue. The persistence of significantly higher ferritin on Day 3 indicates continued inflammatory activation in severe disease despite ongoing management.

Similarly, liver enzymes were significantly elevated in severe dengue. SGOT/AST was significantly higher on Day 1 (284.55 ± 147.25 vs 164.95 ± 103.10 U/L; p = 0.002) and remained significantly elevated on Day 3 (219.20 ± 109.99 vs 127.11 ± 83.79 U/L; p = 0.002). SGPT/ALT also showed significant elevation in severe dengue on Day 1 (178.95 ± 162.61 vs 92.71 ± 53.30 U/L; p = 0.030) and Day 3 (148.00 ± 141.88 vs 73.05 ± 42.97 U/L; p = 0.030). These findings indicate that hepatic injury is more pronounced in severe dengue and that transaminases, especially SGOT, may contribute to prognostic assessment.

In contrast, serum albumin did not differ significantly on Day 1 (p = 0.524) and only showed a non-significant trend toward lower values in severe dengue on Day 3 (3.34 ± 0.27 vs 3.49 ± 0.46 g/dL; p = 0.060). This suggests that albumin alone may be less sensitive as an early predictor of severity compared to ferritin and transaminases, although the Day 3 trend may reflect plasma leakage and disease progression.

[Table 6] ROC-based diagnostic performance of biomarkers for predicting severe dengue (Day 1 and Day 3)

[Table 6] evaluates the diagnostic utility of ferritin, SGOT/AST, SGPT/ALT, and albumin using ROC-derived cut-offs, sensitivity, specificity, and Youden Index (J) for predicting severe dengue.

On Day 1, serum ferritin had the best overall performance with a cut-off of 536.0 ng/mL, high sensitivity (95.0%), good specificity (78.5%), and the highest Youden Index (0.735) among all biomarkers. This indicates that Day 1 ferritin is the strongest discriminator of severe dengue in this study and offers a good balance between detecting severe cases and minimizing false positives. SGOT/AST performed moderately (cut-off 125 U/L, sensitivity 80.0%, specificity 58.5%, J = 0.385), while SGPT/ALT showed lower discriminatory ability (sensitivity 65.0%, specificity 58.5%, J = 0.235). Albumin had the poorest Day 1 performance (sensitivity 50.0%, specificity 66.2%, J = 0.162), reinforcing that albumin alone is a weak prognostic marker for severe dengue at admission.

On Day 3, ferritin remained highly sensitive, with a cut-off of 372.0 ng/mL and 100% sensitivity, meaning all severe dengue cases (among those tested) were identified at this threshold. However, its specificity dropped to 45.8%, reducing overall discrimination (J = 0.458) due to increased false positives among DWS patients. SGOT/AST and SGPT/ALT on Day 3 also showed high sensitivity (88.2% each) but poor specificity (37.5% and 25.0%, respectively), limiting their standalone utility for classification. Albumin again demonstrated poor discriminatory capacity (sensitivity 64.7%, specificity 20.8%, J = 0.145). Overall, these ROC findings indicate that Day 1 ferritin is the most useful single prognostic biomarker in this cohort, while SGOT and SGPT may provide supportive value, especially when interpreted in combination with ferritin and clinical findings.

Table 1: Distribution of dengue severity (WHO 2023 classification) among enrolled children (N = 86)

Category	Number of patients	Percentage (%)
Dengue without warning signs	0	0.0
Dengue with warning signs (DWS)	66	76.7
Severe dengue	20	23.3
Total	86	100.0

Table 2: Clinical severity subtypes among study participants (N = 86)

Severity subtype	Number of patients	Percentage (%)
DWS	66	76.74
Dengue shock syndrome (DSS)	18	20.93
Dengue hemorrhagic fever (DHF)	2	2.33
Total	86	100.00

Table 3: Baseline demographic distribution according to dengue severity

Variable	Category	DWS (n=66)	Severe dengue (n=20)	Total (N=86)	P value
Gender	Female	29	9	38	0.933
	Male	37	11	48	
	Total	66	20	86	
Age group	<1 year	1	0	1	0.660
	1–3 years	5	2	7	
	3–5 years	8	1	9	
	5–12 years	52	17	69	
	Total	66	20	86	

Table 4: Distribution of clinical features and key examination/laboratory signs by severity

Parameter	DWS (n=66)	Severe dengue (n=20)	Total (N=86)	% of total	P value
Symptoms at presentation					
Vomiting	54	19	73	84.8	0.284
Abdominal pain	65	20	85	98.8	1.000
Lethargy	60	17	77	89.5	0.449
Decreased oral intake	65	19	84	97.7	0.365
Refusal to feed	37	13	50	58.1	0.478
Decreased urine output	37	16	53	61.6	0.054
Altered sensorium	7	10	17	19.8	0.001*
Clinical/Laboratory signs					
Thrombocytopenia	63	18	81	94.2	0.361
Raised hematocrit	54	17	71	82.6	0.743
Tender hepatomegaly	47	19	66	76.7	0.027*
Clinical fluid accumulation	27	14	41	47.7	0.022*
Pleural effusion	23	10	33	38.4	0.222
Ascites	29	12	41	47.7	0.307
Pulmonary edema	2	3	5	5.8	0.080

*Statistically significant ($p < 0.05$)

Table 5: Comparison of serial laboratory parameters between DWS and severe dengue

Parameter	DWS (n=66) Mean ± SD	Severe dengue (n=20) Mean ± SD	P value
Age (years)	7.95 ± 2.59	8.15 ± 2.58	0.769
Ferritin (Day 1), ng/mL	378.66 ± 163.53	719.46 ± 245.13	0.001*
Ferritin (Day 3), ng/mL	433.29 ± 135.72	567.71 ± 148.95†	0.006*
SGOT/AST (Day 1), U/L	164.95 ± 103.10	284.55 ± 147.25	0.002*
SGOT/AST (Day 3), U/L	127.11 ± 83.79	219.20 ± 109.99	0.002*
SGPT/ALT (Day 1), U/L	92.71 ± 53.30	178.95 ± 162.61	0.030*
SGPT/ALT (Day 3), U/L	73.05 ± 42.97	148.00 ± 141.88	0.030*
Albumin (Day 1), g/dL	3.36 ± 0.23	3.41 ± 0.23	0.524
Albumin (Day 3), g/dL	3.49 ± 0.46	3.34 ± 0.27	0.060

*Statistically significant ($p < 0.05$)

†Day 3 ferritin value available for 17 severe dengue cases (as provided)

Table 6: ROC-based diagnostic performance of biomarkers for predicting severe dengue (Day 1 and Day 3)

Day of admission	Parameter	Cut-off	Sensitivity	Specificity	Youden Index (J)
Day 1	Ferritin	536.0	0.950	0.785	0.735
	SGOT/AST	125.0	0.800	0.585	0.385
	SGPT/ALT	85.0	0.650	0.585	0.235
	Albumin	3.450	0.500	0.662	0.162
Day 3	Ferritin	372.0	1.000	0.458	0.458
	SGOT/AST	89.5	0.882	0.375	0.257
	SGPT/ALT	45.0	0.882	0.250	0.132
	Albumin	3.250	0.647	0.208	0.145

DISCUSSION

In the present study, the severity profile was skewed toward hospitalized sick children, with 76.7% (66/86) classified as dengue with warning signs (DWS) and 23.3% (20/86) as severe dengue, while no child had dengue without warning signs. This pattern is consistent with referral-center enrichment of more severe phenotypes and differs from mixed-level hospital cohorts. For example, Rathod et al. (2019) reported a broader spectrum among 100 children, with 45% dengue without warning signs, 44% DWS, and 11% severe dengue, reflecting inclusion of less severe cases in addition to hospitalized children. Our higher severe-disease proportion is therefore likely related to tertiary-care case selection rather than a true community-level increase in severity.[7] Within severe phenotypes, our cohort showed predominance of shock presentations, with DSS in 18/86 (20.93%) and DHF in only 2/86 (2.33%), indicating that circulatory compromise was the major severe manifestation. This aligns with the broader evidence base emphasizing warning signs and progression markers linked to plasma leakage and hemodynamic deterioration rather than hemorrhage alone. In the meta-analysis by Tsheten et al. (2021) (143 studies), WHO warning signs overall retained predictive value for severe dengue, supporting the clinical relevance of triage-centered classification used in our study, even though the exact distribution of DSS and DHF varies across settings and outbreaks.[8] Regarding demographics, our study found no significant association of severity with either gender (female severe 9/38 [23.7%] vs male severe 11/48 [22.9%]; p=0.933) or age group (p=0.660), despite the majority of admissions being in the 5–12 year group (69/86; 80.2%). This is comparable to pediatric hospital-based datasets where older children comprise most cases but severity is not always age-dependent within the admitted cohort. Reddy et al. (2021), in 104 confirmed pediatric dengue cases, similarly reported that the 5–10 year age group formed the majority (51.9%) and males were 61.5%, but highlighted that severity is better explained by clinical and hemodynamic parameters than by demographic variables alone.[9] Among presenting symptoms, our cohort showed very high frequencies of abdominal pain (98.8%), decreased oral intake (97.7%), lethargy (89.5%), and vomiting (84.8%), but these did not significantly distinguish DWS from severe dengue. This likely reflects the fact that the study population itself was already enriched with warning-sign cases. In comparison, Sreenivasan et al. (2020), in a prospective pediatric cohort of 350 serologically confirmed children, found that warning signs such as persistent vomiting and mucosal bleed contributed to prediction of progression time to severe dengue, while clinical fluid accumulation remained the most robust signal in multivariable analysis (HR around 1.89, p=0.02). Thus, our results support that common warning symptoms are frequent in admitted children but may be less discriminatory unless analyzed temporally for progression risk.[10]

A key clinical discriminator in our study was altered sensorium, present in 17/86 (19.8%) overall and significantly associated with severity (10/20 severe vs 7/66 DWS; p=0.001). We also observed a near-significant trend with decreased urine output (16/20 severe vs 37/66 DWS; p=0.054), suggesting evolving shock/organ hypoperfusion. This pattern is concordant with Reddy et al. (2021), who reported that altered sensorium, oliguria, hypotension, low pulse pressure, and significant gastrointestinal bleeding were more common in severe dengue, reinforcing the importance of neurological status and perfusion markers as bedside indicators of severe disease in children.[9] For examination and routine

hematologic/plasma leakage markers, our study found thrombocytopenia (94.2%) and raised hematocrit (82.6%) to be very common but not significantly associated with severity (p=0.361 and p=0.743), whereas tender hepatomegaly (76.7%; p=0.027) and clinical fluid accumulation (47.7%; p=0.022) were significant. This profile is partly comparable to pooled evidence and partly different from some single-center reports. In the meta-analysis by Tsheten et al. (2021), WHO warning signs as a group were associated with severe dengue, but performance of individual signs varied by population, timing, and case mix. Our findings suggest that in a tertiary inpatient pediatric cohort, dynamic leakage markers (clinical fluid accumulation) and hepatic involvement may outperform isolated platelet count/hematocrit in distinguishing severe disease at admission.[11] The central finding of this study is the strong association of hyperferritinemia with severe dengue. We observed significantly higher ferritin in severe dengue on Day 1 (719.46 ± 245.13 ng/mL) versus DWS (378.66 ± 163.53 ng/mL; p=0.001), with the difference persisting on Day 3 (567.71 ± 148.95 vs 433.29 ± 135.72 ng/mL; p=0.006). These results are in line with pediatric evidence from Golhar et al. (2023) in children aged 1 month–12 years, where ferritin measured both at admission and defervescence was significantly associated with dengue severity (p=0.0001 and p=0.0012, respectively) and in-hospital mortality; their cohort of 92 children had 12% severe disease and 3.2% mortality. The concordance across two pediatric tertiary-care studies supports ferritin as a reproducible severity biomarker rather than an incidental inflammatory marker.[12] Our transaminase findings also support the prognostic role of hepatic injury: severe dengue had significantly higher SGOT/AST on Day 1 (284.55 ± 147.25 vs 164.95 ± 103.10 U/L; p=0.002) and Day 3 (219.20 ± 109.99 vs 127.11 ± 83.79 U/L; p=0.002), and higher SGPT/ALT on Day 1 (178.95 ± 162.61 vs 92.71 ± 53.30 U/L; p=0.030) and Day 3 (148.00 ± 141.88 vs 73.05 ± 42.97 U/L; p=0.030), while albumin showed only a nonsignificant Day-3 downward trend (p=0.060). This is consistent with pediatric hepatic-involvement data from Alam et al. (2024) (n=190), who reported raised AST in 65.8%, raised ALT in 52.6%, and emphasized that AST tends to exceed ALT in dengue; they also found hepatic and leakage-related findings (including hepatomegaly/pleural effusion/ascites) to be significantly linked with severe disease. Our study similarly demonstrates that AST/ALT are useful supportive markers of severity, but albumin alone had limited discriminatory utility early in admission.[13] ROC analysis in our study confirmed Day-1 ferritin as the best single predictor of severe dengue, with a cut-off of 536 ng/mL, sensitivity 95.0%, specificity 78.5%, and Youden index 0.735, outperforming SGOT (J=0.385), SGPT (J=0.235), and albumin (J=0.162); by Day 3, ferritin sensitivity increased to 100% but specificity dropped (45.8%), indicating improved case capture at the expense of false positives. This pattern is comparable to the ROC behavior reported by Suresh et al. (2020) in dengue patients, where ferritin was a stronger predictor of severe disease than platelet count/hematocrit, with Day-1 ferritin AUC 0.863, cut-off 1,990 ng/mL, sensitivity 94.1%, and specificity 71.1%, and even higher Day-4 performance (AUC 0.947). Although their cohort was adult and used different cutoffs, the diagnostic hierarchy is similar to our findings: ferritin > transaminases > albumin/isolated conventional markers for early severity prediction.[14]

CONCLUSION

This prospective observational study in children aged 1 month to 12 years demonstrated that serum ferritin, SGOT (AST), and SGPT (ALT) were significantly higher in severe dengue compared with dengue with warning signs, with serum ferritin emerging as the strongest prognostic marker. Ferritin showed the best diagnostic performance on ROC analysis, particularly on Day 1 of admission, indicating its usefulness for early risk stratification. Clinical features such as altered sensorium, tender hepatomegaly, and clinical fluid accumulation were also significantly associated with severe dengue. These findings support the use of serial ferritin and liver enzyme measurements, along with clinical assessment, for early identification and closer monitoring of children at risk of severe dengue in tertiary care settings.

REFERENCES

1. Centers for Disease Control and Prevention. Clinical features of dengue [Internet]. Atlanta: CDC; 2025 May 15 . Available from: https://www.cdc.gov/dengue/hcp/clinical-signs/index.html
2. National Center for Vector Borne Diseases Control, Directorate General of Health Services, Ministry of Health & Family Welfare, Government of India. National guidelines for clinical management of dengue fever 2023 [Internet]. New Delhi: NCVBDC; 2023. Available from: https://ncvbdc.mohfw.gov.in/Doc/National%20Guidelines%20for%20Clinical%20Management%20of%20Dengue%20Fever%202023.pdf
3. Moallemi S, Lloyd AR, Rodrigo C. Early biomarkers for prediction of severe manifestations of dengue fever: a systematic review and a meta-analysis. Sci Rep. 2023;13(1):17485. doi:10.1038/s41598-023-44559-9. Available from: https://www.nature.com/articles/s41598-023-44559-9
4. Goyal PK, Singh P, Pareek V, Mittal A, Sharma D, Sharma S, et al. Role of serum ferritin as a predictor of dengue severity. Cureus. 2024;16(5):e60163. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC11288214/
5. Nguyen RN, Lam HT, Phan HV. Liver impairment and elevated aminotransferase levels predict severe dengue in Vietnamese children. Cureus. 2023;15(10):e47606. doi:10.7759/cureus.47606. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC10597804/
6. Srivastava G, Chhavi N, Goel A. Validation of serum aminotransferases levels to define severe dengue fever in children. Pediatr Gastroenterol Hepatol Nutr. 2018;21(4):289-296. doi:10.5223/pghn.2018.21.4.289. Available from: https://pghn.org/DOIx.php?id=10.5223/pghn.2018.21.4.289

7. Rathod NP, Ansari NJR, Singh DK. Clinical profile of children with dengue and factors associated with severe dengue and dengue with warning signs. Pediatr Oncall J. 2018;15(1):1-4. doi:10.7199/ped.oncall.2018.13. Available from: https://www.pediatriconcall.com/pediatric-journal/view/fulltext-articles/1146/J/0/0/605/0
8. Tsheten T, Clements ACA, Gray DJ, Adhikary RK, Furuya-Kanamori L, Wangdi K. Clinical predictors of severe dengue: a systematic review and meta-analysis. Infect Dis Poverty. 2021;10(1):123. doi:10.1186/s40249-021-00908-2. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8501593/
9. Reddy ARD, Mahesh K, Ramesh M, et al. A study on predictors of severe dengue in pediatric patients in a tertiary care hospital in Telangana. Indian J Child Health. 2021;8(1):18-22. Available from: https://mansapublishers.com/index.php/ijch/article/view/2820
10. Sreenivasan P, Geetha S, Santhosh Kumar A. WHO 2009 warning signs as predictors of time taken for progression to severe dengue in children. Indian Pediatr. 2020;57(10):899-903. Available from: https://pubmed.ncbi.nlm.nih.gov/33089804/
11. Karyanti MR, Uiterwaal CSPM, Hadinegoro SR, Widyahening IS, Saldi SRF, Heesterbeek JAPH, et al. The value of warning signs from the WHO 2009 dengue classification in detecting severe dengue in children. Pediatr Infect Dis J. 2024;43(7):630-634. doi:10.1097/INF.0000000000004326. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC11191040/
12. Golhar S, Madhura A, Khwaja S, Chauhan U. Association of clinical parameters and serum ferritin with dengue fever severity and in-hospital outcome in children aged 1 month to 12 years: a prospective, observational study at a tertiary care center in central India. Infect Dis Trop Med. 2023;9:e1074. doi:10.32113/idtm_20232_1074. Available from: https://www.infectiousjournal.com/article/1074
13. Alam R, Fathema K, Akter M, Sultana N, Ahmed S, et al. Prediction of severity of dengue infection in children based on hepatic involvement. Health Sci Rep. 2024;7:e1933. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC10938065/
14. Suresh SC, Hanumanthaiah R, Ramakrishna C, Sandeep R, Narasimhasetty PS, Ramakrishna V, et al. Serum ferritin as a prognostic indicator in adult dengue patients. Am J Trop Med Hyg. 2021;104(3):1072-1078. doi:10.4269/ajtmh.20-1111. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7941811/.