

Prolonged and Saddleback Fever in Children with Dengue: Prevalence and Severity Correlation in a Paediatric Intensive Care Unit

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Abstract

Background:

Dengue fever remains a major global health concern, particularly in pediatric populations in endemic countries like Bangladesh.

Objective:

This study aimed to evaluate the prevalence of prolonged and saddleback fever patterns and their association with clinical severity and outcomes among pediatric dengue patients.

Methods:

This cross-sectional analytical study was conducted in the Pediatric Intensive Care Unit (PICU) of Bangladesh Shishu Hospital and Institute from August 2023 to February 2025. A total of 47 pediatric dengue patients under <18 years with confirmed infection (NS1 or IgM positive) were analyzed. Fever patterns were categorized as prolonged or biphasic (saddleback). Patients without prolonged or saddle-back fever were considered controls. Clinical presentations, laboratory parameters, complications, and outcomes were documented. Logistic and linear regression analyses were conducted to determine the association between fever pattern and disease severity.

Results:

Prolonged and saddleback fever groups demonstrated significantly higher complications, including hepatic involvement (OR=2.50, p=0.04) and co-infections (OR=4.21, p=0.03). Both groups exhibited pronounced thrombocytopenia (platelets <50,000/ μ L), hematocrit elevations (>20%), and severe coagulopathy compared to controls. Mortality was notably higher in prolonged fever (18.2%) and saddleback fever (16.7%) groups versus controls (3.3%). Logistic regression revealed prolonged fever significantly reduced the odds of clinical improvement (OR=0.13, p=0.03), while saddleback fever showed a borderline significant reduction (OR=0.22, p=0.05). Male sex (OR=1.65, p=0.05) and older age (OR=1.22, p=0.002) increased the likelihood of prolonged or saddleback fever.

Conclusion:

Prolonged and saddleback fever trajectories in pediatric dengue patients are associated with heightened clinical severity, increased complication risks and reduced survival. Recognition of these fever patterns could enhance early clinical risk stratification, guiding management and optimizing outcomes in pediatric dengue, particularly in resource-limited endemic regions.

Keywords: Dengue fever, Pediatric intensive care, Prolonged fever, Saddleback fever, Disease severity

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Introduction:

Dengue fever, a mosquito-borne viral disease transmitted primarily by *Aedes aegypti* and *Aedes albopictus*, poses a major global health challenge,

particularly in tropical and subtropical regions. The World Health Organization (WHO) estimates nearly 390 million infections annually, with 96 million symptomatic cases.¹ In South and Southeast

Asia, factors such as rapid urbanization, climate change, and global travel have intensified the spread of dengue virus serotypes.² Bangladesh has been notably affected, with recurrent epidemics since 2000 and increasingly severe outbreaks. The 2019 epidemic recorded over 100,000 confirmed cases and 164 deaths, while 2023 saw the deadliest outbreak in the country's history, with 277,801 cases and 1,393 deaths.^{3,4} These epidemics highlight not only the endemicity of dengue but also the severe strain placed on healthcare systems, particularly pediatric intensive care units (PICUs), where children often present with critical complications.⁵ The clinical course of dengue typically lasts 3–7 days, with high fever, myalgia, arthralgia, and rash.⁶ However, variations in fever trajectory, especially prolonged fever (>7 days) and biphasic (saddleback) fever, have raised concerns about their prognostic implications. Prolonged fever has been linked to hemorrhage, organ dysfunction, and dengue shock syndrome (DSS),⁷ while biphasic fever, characterized by an initial fever resolution followed by recurrence, often signals vascular permeability and plasma leakage.⁸ Despite these associations, consensus on their predictive value remains lacking, especially in pediatric populations admitted to PICUs.³ Existing research has predominantly focused on adults, leaving pediatric cases underexplored.⁹ Severe dengue in children is often atypical and progresses rapidly to DSS, hemorrhage, and multi-organ failure.¹⁰ A recent Bangladeshi study observed biphasic fever in hospitalized dengue patients but found no direct correlation with severe outcomes.⁵ Nonetheless, recognizing fever patterns early could aid in risk stratification, enabling timely interventions, resource optimization, and enhanced monitoring in high-risk pediatric cases.⁶ Studies in

adults suggest prolonged and biphasic fever correlates with inflammatory markers such as elevated liver enzymes and thrombocytopenia, both linked to severe complications.⁷ However, pediatric-specific evidence remains sparse, and no standardized protocol incorporates fever pattern analysis into severity classification.^{3,4} This study, therefore, aims to evaluate the prevalence of prolonged and biphasic fever in pediatric dengue patients admitted to PICUs in Bangladesh and their potential association with disease severity.

Methods:

This cross-sectional analytical study was conducted at the Paediatric Intensive Care Unit of Bangladesh Shishu Hospital and Institute from August 2023 to February 2025. A total of 56 children (<18 years) with confirmed dengue (NS1 or IgM positive) were enrolled, with exclusions for comorbidities and overlapping fever types, yielding 47 participants. Patients were categorized into prolonged fever (n=11), saddleback fever (n=6), and control (n=30). Demographics, clinical features, complications, and outcomes were documented through guardian interviews, examinations, and reports. Ethical approval was obtained. Data were analyzed using SPSS v26 with descriptive and multivariate analyses; $p < 0.05$ was considered significant.

Results:

Overall, older children (age >5–18 years) predominated in the prolonged fever group (54.5%) and the control group (50%), whereas the saddleback fever group contained a relatively higher proportion of younger children aged 1–5 years (50%). Males accounted for most cases in all three groups, reaching 63.6% in the prolonged fever group and 66.7% in the saddleback fever group (Figure-1).

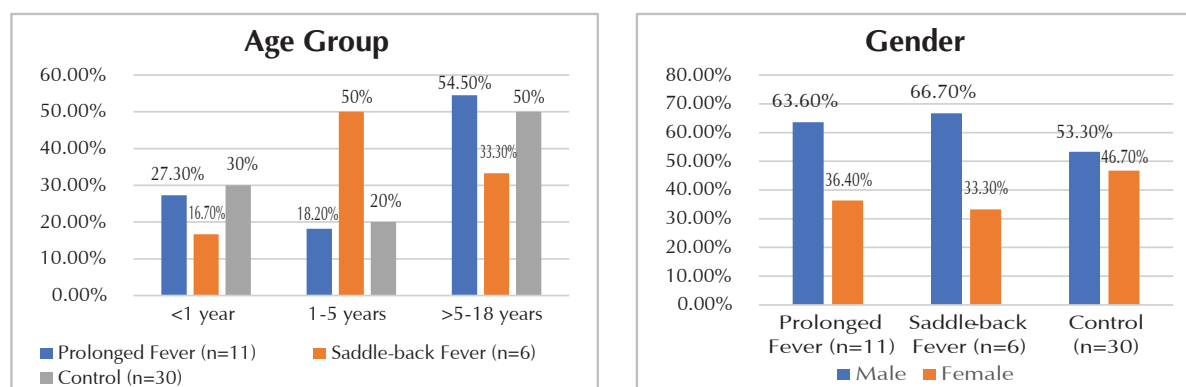


Figure-1: Comparison of Baseline Characteristics (N=47)

Expanded Dengue Syndrome was most frequent in both prolonged (63.6%) and saddleback fever (66.7%) groups, while Dengue Shock Syndrome occurred in all groups, highest in prolonged fever (36.4%). In contrast, warning signs and DHF without shock were observed only in the control group (Table-I).

Table-I: Comparison of clinical features (N=47)

Severity classification	Prolonged Fever (n=11) no. (%)	Saddle-back Fever (n=6) no. (%)	Control (n=30) no. (%)
Dengue fever with a warning sign	0	0	9(30)
Dengue haemorrhagic fever (DHF) without shock	0	0	1(3.33)
Dengue shock syndrome (DSS)	4(36.36)	2(33.33)	10(33.33)
Expanded dengue syndrome	7(63.63)	4(66.66)	10(33.33)

Gastrointestinal symptoms were highest in saddleback fever (83.3%), followed by prolonged fever (72.7%) and controls (70%). Petechial rashes were more frequent in prolonged (27.3%) and saddleback (33.3%) groups versus controls (13.3%). Fluid accumulation and respiratory distress affected 66.7% of saddleback and 54.5% of prolonged cases, compared to 43.3% of controls (Table-II).

Table-II: Comparison of clinical severity among prolonged and saddle-back fever groups

Clinical feature	Prolonged Fever (n=11) no. (%)	Saddle-back Fever (n=6) no. (%)	Control (n=30) no. (%)
Gastrointestinal symptoms	8(72.7)	5(83.3)	21(70)
Mucosal bleeding	2(18.2)	1(16.7)	5(16.7)
Petechiae	3(27.3)	2(33.3)	4(13.3)
Fluid accumulation	6(54.5)	4(66.7)	13(43.3)
Respiratory distress	6(54.5)	4(66.7)	13(43.3)
Hypotension	5(45.5)	3(50)	12(40)
Hepatomegaly	5(45.5)	3(50)	12(40)

Patients with prolonged and saddleback fever demonstrated significantly greater lab abnormalities than controls. Over 80% had hematocrit rise >20%, thrombocytopenia <50,000, and elevated liver enzymes, versus ~25% in controls. Altered renal function was seen in 63.6% (prolonged) and 50% (saddleback) compared to 6.7% of controls, while hyperserotonemia and high procalcitonin (>2 ng/mL) were also markedly more frequent in these groups (Table-III).

Table-III: Laboratory parameters in each group (prolonged fever vs saddle-back fever vs control group)

Laboratory variable	Prolonged Fever Group (n=11)	Saddle-back Fever Group (n=6)	Control Group (n=30)
Change of HCT >20%	9(81.8)	5(83.3)	8(26.7)
Thrombocytopenia <50,000/mm ³	9(81.8)	4(66.7)	5(16.7)
Severe leukopenia <2000/mm ³	8(72.7)	3(50)	4(13.3)
Altered liver enzyme	10(90.9)	5(83.3)	7(23.3)
Altered renal function	7(63.6)	3(50)	2(6.7)
Hypoalbuminemia <35 g/dL	6(54.5)	3(50)	4(13.3)
Coagulopathy (Prolonged PT, APTT, D-dimer)	10(90.9)	5(83.3)	6(20)
Hyperferritinemia >1000 ng/mL	8(72.7%)	4(66.7)	5(16.7)
Raised procalcitonin >2 ng/mL	7(63.6%)	4(66.7)	5(16.7)

Most patients in all three groups survived, with the control group achieving the highest improvement rate (96.7%). In comparison, mortality was notably higher among those with prolonged fever (18.2%) and those with saddleback fever (16.7%), while the control group experienced only one death (3.3%) (Figure-2).

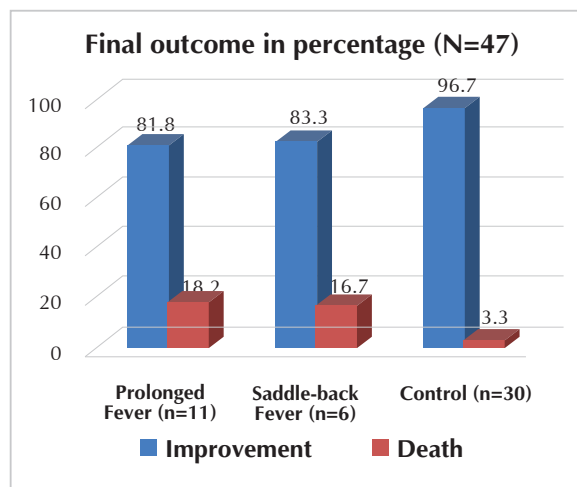


Figure-2: Comparison of final outcome (n=47)

Logistic regression showed that older age was significantly associated with a higher likelihood of being in the prolonged or saddleback fever group compared to the control group (OR=1.22, $p=0.002$). Male sex likewise had a moderate association with the fever patterns (OR=1.65, $p=0.05$) (Table-IV).

Table-IV: Logistic regression analysis comparing prolonged fever and saddle-back fever groups to the control group according to demographic characteristics

Predictor	β (Coefficient)	Standard Error	p- value	Odds Ratio (OR)	95% Confidence Interval (OR)
Age (Years)	0.2	0.05	0.002	1.22	1.12–1.34
Male (Sex)	0.5	0.3	0.05	1.65	1.02–2.68

Dependent Variable: Fever Group (0=Control, 1=Prolonged Fever, 2=Saddle-back Fever)

Table-V: Logistic regression for organ involvement (myocarditis vs. no myocarditis)

Predictor	β (Coefficient)	Standard Error	p- value	Odds Ratio (OR)	95% Confidence Interval (OR)
Fever group (Prolonged)	1.5	0.8	0.06	4.50	0.98–21.16
Fever group (Saddle-back)	1.2	0.6	0.07	3.32	0.97–11.33
Age (Years)	0.05	0.1	0.57	1.05	0.90–1.23
Co-infection (Culture-positive Sepsis, Pneumonia)	2.0	0.9	0.03	7.39	1.10–49.45

Dependent Variable: Fever Group (0=Control, 1=Prolonged Fever, 2=Saddle-back Fever)

Children with prolonged fever (OR=4.50, $p=0.06$) or saddleback fever (OR=3.32, $p=0.07$) demonstrated a higher risk of myocarditis, although both associations approached rather than reached conventional significance. Co-infection (pneumonia or culture-positive sepsis) was significantly associated with myocarditis (OR=7.39, $p=0.03$). Age did not exert a meaningful effect on myocarditis risk (Table-V). Both myocarditis ($p=0.07$) and pulmonary involvement ($p=0.05$) were significantly more common in the prolonged and saddleback fever

proportions in the prolonged and saddleback groups than in controls but did not reach conventional significance levels (Table-VI).

Logistic regression revealed that prolonged fever significantly lowered the odds of clinical improvement (OR=0.13, $p=0.03$), while saddleback fever also showed a trend toward worse outcomes (OR=0.22, $p=0.05$). Age did not exert a notable impact on outcome ($p=0.54$). In terms of organ involvement, liver involvement was associated with decreased likelihood of improvement (OR=0.27, $p=0.04$). Co-infection

groups than in controls. Hepatic involvement ($p=0.04$) and co-infections ($p=0.03$) were significantly elevated among those with prolonged or saddleback fever. CNS involvement ($p=0.08$) and renal involvement ($p=0.09$) showed higher

with pneumonia or culture-positive sepsis approached significance ($p=0.08$), further suggesting a negative influence on outcome (Table-VII).

Table-VI: Comparison of complications in prolonged and saddle-back fever groups

Complication	Prolonged Fever Group (n=11)	Saddle-back Fever Group (n=6)	Control Group (n=30)	p-value	Odds Ratio (95% CI)
Myocarditis	2(18.2%)	1(16.7%)	2(6.7%)	0.07	4.50(0.98–21.16)
Pulmonary involvement	4(36.4%)	3(50%)	8(26.7%)	0.05	3.32(0.97–11.33)
CNS involvement (Encephalopathy)	1(9.1%)	1(16.7%)	1(3.3%)	0.08	3.12(0.87–10.92)
Hepatic involvement	3(27.3%)	2(33.3%)	6(20%)	0.04	2.50(1.12–6.23)
Renal involvement	1(9.1%)	0(0%)	1(3.3%)	0.09	2.87(0.92–9.12)
Co-infections (Culture-positive sepsis, pneumonia)	4(36.4%)	2(33.3%)	5(16.7%)	0.03	4.21(1.08–10.36)

Table-VII: Logistic regression for final outcome (improvement vs. death)

Predictor	β (Coefficient)	Standard Error	p-value	Odds Ratio (OR)	95% Confidence Interval (OR)
Fever group (Prolonged)	-2.0	0.9	0.03	0.13	0.02–0.85
Fever group (Saddle-back)	-1.5	0.7	0.05	0.22	0.04–1.14
Age (Years)	-0.1	0.2	0.54	0.91	0.60–1.35
Organ involvement (Liver)	-1.3	0.6	0.04	0.27	0.08–0.89
Co-infection (Culture-positive sepsis, pneumonia)	-0.9	0.5	0.08	0.41	0.16–1.02

Dependent variable: Outcome (1=Improvement, 0=Death)

Discussion:

Dengue fever remains a significant concern in Bangladesh, with pediatric cases posing challenges in management. This study explored prolonged and saddleback (biphasic) fever patterns and their links to severity, complications, and outcomes. Both patterns were associated with more severe illness, with prolonged fever showing the strongest correlation with poor prognosis. Age distribution showed older children (5–18 years) predominated in the prolonged (54.5%) and

control (50%) groups, while the saddleback group had more 1–5-year-olds (50%), consistent with Hossain et al, who associated younger age with severe pediatric dengue.¹¹ Male predominance was noted across groups (prolonged: 63.6%, saddleback: 66.7%, control: 53.3%), with logistic regression indicating a moderate association ($p=0.05$, OR=1.65), aligning with prior reports of male sex as a risk factor.¹² Clinically, gastrointestinal symptoms were most frequent in saddleback fever (83.3%). Petechiae were more

common in prolonged (27.3%) and saddleback (33.3%) groups than controls (13.3%), reflecting vascular fragility. Fluid accumulation and respiratory distress were also higher in prolonged (54.5%) and saddleback (66.7%) cases, consistent with studies linking fluctuating fever to vascular leakage.¹³ Laboratory abnormalities were striking: hematocrit rise $>20\%$ occurred in 81.8% of prolonged and 83.3% of saddleback patients versus 26.7% of controls, while severe thrombocytopenia ($<50,000/\mu\text{L}$) was found in 81.8% and 66.7%, respectively. Coagulopathy was markedly more frequent in prolonged (90.9%) and saddleback (83.3%) groups compared with controls (20%).^{5,14} Complications were significantly greater in prolonged and saddleback fever. Hepatic dysfunction ($p=0.04$, $\text{OR}=2.50$) and co-infections ($p=0.03$, $\text{OR}=4.21$) were notable, supporting previous findings that elevated AST/ALT prolong morbidity¹⁵ and that secondary infections worsen outcomes.¹⁶ Myocarditis ($p=0.07$) and pulmonary involvement ($p=0.05$) were also more common, echoing evidence of cardiopulmonary complications in severe dengue.¹⁷ Outcome analysis revealed mortality rates of 18.2% (prolonged) and 16.7% (saddleback), compared to 3.3% in controls. Prolonged fever significantly reduced survival ($p=0.03$, $\text{OR}=0.13$), while hepatic dysfunction ($p=0.04$, $\text{OR}=0.27$) and pneumonia co-infection ($p=0.08$) further worsened outcomes.^{18,19} Logistic regression identified older age ($\beta=0.2$, $p=0.002$, $\text{OR}=1.22$) and male sex ($\beta=0.5$, $p=0.05$, $\text{OR}=1.65$) as predictors of prolonged or saddleback fever. To sum up, prolonged and saddleback fever patterns in pediatric dengue are strongly associated with severe disease, complications, and higher mortality. While thrombocytopenia, hematocrit rise, and liver dysfunction remain established predictors,²⁰ incorporating fever trajectory into severity models may improve early risk stratification and guide resource allocation in endemic regions.

Limitations:

The study was conducted in a single centre with a small sample size, including PICU patients only. So, the results may not represent the whole community.

Conclusion:

This study highlighted the significant clinical

implications of prolonged and saddleback fever patterns in pediatric dengue patients admitted to the pediatric intensive care unit in Bangladesh. Both fever patterns were associated with increased clinical severity, higher complication rates, and worse clinical outcomes, including higher mortality. These findings underscored the potential value of incorporating fever trajectory into early clinical risk stratification, facilitating timely intervention, optimized resource utilization, and improved management strategies for high-risk pediatric dengue cases in resource-limited settings. Further large-scale prospective studies are recommended to validate fever patterns as reliable prognostic indicators and integrate them into standardized dengue severity guidelines.

Conflict of interest: None declared

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