

# Comparison of Clinical and Biochemical Characteristics Between Dengue Fever and Dengue Hemorrhagic Fever in Pediatric Patients

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## ABSTRACT

**Background:** Dengue infection in children has a broad clinical spectrum, ranging from uncomplicated dengue fever (DF) to dengue hemorrhagic fever (DHF), which may progress to shock and severe organ involvement. Early identification of clinical and laboratory features associated with DHF is important for timely management. **Methods & Materials:** This prospective longitudinal study was conducted among confirmed dengue patients aged 1 month to 12 years admitted to the Department of Pediatrics, Dhaka Medical College Hospital, Dhaka, Bangladesh, from January to December 2022. After ethical approval and informed consent, 350 eligible children were included. Clinical, hematological and biochemical characteristics were compared between DF and DHF groups. Data were analyzed using SPSS version 23.0. **Results:** Among 350 children, 133 (38%) had DF and 217 (62%) had DHF. Urban residence was more common among DHF patients (161 vs. 14;  $p=0.001$ ). Skin rash was more frequent in DF (119 vs. 49;  $p<0.001$ ), whereas vomiting (119 vs. 49;  $p=0.001$ ) and hepatomegaly (103 vs. 21;  $p=0.002$ ) were more common in DHF. Low urine output, low pulse volume and shock were significantly associated with DHF ( $p=0.001$ ,  $p=0.006$  and  $p=0.001$ , respectively). Raised hematocrit, leukopenia and thrombocytopenia were significantly more frequent in DHF ( $p<0.004$ ,  $p<0.001$  and  $p<0.001$ , respectively). Elevated ALT and AST were also significantly more common in DHF (both  $p<0.001$ ). **Conclusion:** DHF showed more severe clinical, hematological and biochemical abnormalities than DF. Early recognition of these features may facilitate timely intervention and reduce complications.

**Keywords:** Dengue fever; Dengue hemorrhagic fever; Pediatric dengue; Thrombocytopenia; Hematocrit; Liver enzymes.

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## INTRODUCTION

Dengue is an important mosquito-borne viral infection and remains a major public health concern in tropical and subtropical regions [1]. It is caused by dengue virus, which belongs to the genus *Flavivirus* and is transmitted predominantly by *Aedes* mosquitoes. Dengue infection affects individuals of all age groups, but children may be particularly vulnerable to rapid clinical deterioration and severe complications [2,3]. The clinical spectrum ranges from self-limiting febrile illness to severe disease characterized by plasma leakage, bleeding, shock and involvement of vital organs [4].

Dengue fever (DF) is generally characterized by acute febrile illness accompanied by symptoms such as headache, retro-orbital pain, myalgia, arthralgia, skin rash, nausea, vomiting and constitutional symptoms. Most patients recover with supportive treatment; however, some may progress to dengue hemorrhagic fever (DHF), which represents a more severe form of dengue infection [5]. DHF is

characterized by increased vascular permeability and plasma leakage, which can lead to hemoconcentration, pleural effusion, ascites, circulatory compromise and shock [6]. Dengue shock syndrome, occurring when significant plasma leakage results in circulatory failure, is one of the most serious complications and may rapidly become life-threatening without timely intervention [7]. The clinical manifestations of dengue in children can vary considerably, making early recognition of severe disease challenging. Symptoms such as persistent vomiting, abdominal pain, lethargy, hepatomegaly, reduced urine output and circulatory abnormalities may indicate progression toward severe dengue [8]. Laboratory abnormalities also provide important information regarding disease severity. Leukopenia and thrombocytopenia are commonly observed during dengue infection, while rising hematocrit may indicate plasma leakage [9]. In addition, hepatic involvement is frequent, with elevated alanine aminotransferase and aspartate aminotransferase levels reflecting

varying degrees of liver injury [10].

Distinguishing DF from DHF at an early stage is clinically important because children with DHF require closer monitoring and prompt recognition of plasma leakage and circulatory compromise [11]. Assessment of clinical manifestations together with hematological and biochemical parameters may therefore help clinicians identify patients at greater risk of severe disease and guide appropriate management [12].

Despite the generally favorable outcome of uncomplicated dengue infection, severe dengue remains an important cause of morbidity and mortality among children. A better understanding of the differences in clinical and biochemical characteristics between DF and DHF may facilitate early risk assessment, timely intervention and improved outcomes. Therefore, this study was undertaken to compare the clinical and biochemical characteristics of pediatric patients with dengue fever and dengue hemorrhagic fever.

METHODS & MATERIALS

This prospective longitudinal study was conducted in the Department of Pediatrics, Dhaka Medical College Hospital, Dhaka, Bangladesh, from January 2022 to December 2022, after obtaining ethical clearance from the appropriate Ethical Review Committee. The study population comprised confirmed dengue patients aged 1 month to 12 years who were admitted to the department during the study period and fulfilled the predefined inclusion and exclusion criteria.

Inclusion criteria:

Children aged from 1month to 12 years with NS1 antigen positive or positive dengue IgM antibody with or without positive dengue IgG antibody.

Exclusion criteria:

Both dengue NS1 and IgM negative or only Dengue IgG positive. Expanded dengue syndrome. Dengue fever associated with chronic disease like - congenital heart disease, chronic kidney disease, chronic

liver disease, malignancy, severe acute malnutrition, epilepsy etc.

A structured questionnaire was used for data collection. Written informed consent was obtained from parents or legal guardians before enrollment. A total of 380 children were initially enrolled, and the present analysis included 350 pediatric patients categorized as dengue fever (DF) or dengue hemorrhagic fever (DHF), with or without shock. Detailed clinical history and thorough physical examinations were performed. Dengue cases were defined and classified according to the National Guideline for Clinical Management of Dengue Syndrome, 4th Edition, 2018 (Revised). Relevant clinical characteristics, including headache, retro-orbital pain, lethargy, skin rash, vomiting, abdominal pain, hepatomegaly, unconsciousness, urine output, pulse volume and shock, were recorded.

Blood samples were collected for complete blood count, hematocrit, leukocyte and platelet counts, alanine aminotransferase (ALT) and aspartate aminotransferase (AST). Patients received appropriate

management according to the standard pediatric dengue management protocol. Data were processed, compiled and analyzed using the Statistical Package for the Social Sciences (SPSS) version 23.0 and were presented as frequency, percentage and tables.

RESULTS

Table I presents the demographic characteristics of the pediatric patients with DF and DHF. Among the 350 patients, 165 were male and 185 were female. In the DF group, 77 (58%) were male and 56 (42%) were female, whereas the DHF group included 88 (41%) male and 129 (59%) female patients. Regarding residence, most patients were from urban areas (175), with 14 in the DF group and 161 in the DHF group (p=0.001). Travel to an endemic zone was reported in 70 patients, equally distributed between DF and DHF groups (35 each; p=0.021). Associated co-infection was present in 82 patients, with no significant difference between the groups (p=0.182).

Table I

Demographic Characteristics of Pediatric Patients with Dengue Fever and Dengue Hemorrhagic Fever (n=350).

| Variable                | Total (N=350) | DF (n=133) | DHF (n=217) | p value |
|-------------------------|---------------|------------|-------------|---------|
| Sex                     |               |            |             |         |
| Male                    | 165           | 77 (58%)   | 88 (41%)    | 0.021   |
| Female                  | 185           | 56 (42%)   | 129 (59%)   | 0.035   |
| Residence               |               |            |             |         |
| Rural                   | 35            | 28         | 7           | <0.001  |
| Semi-urban              | 140           | 91         | 49          | 0.59    |
| Urban                   | 175           | 14         | 161         | 0.001   |
| Travel to endemic zone  | 70            | 35         | 35          | 0.021   |
| Associated co-infection | 82            | 42         | 40          | 0.182   |

Table II compares the major clinical characteristics between children with DF and DHF. Headache was reported in 153 patients, while retro-orbital pain and lethargy were present in 63 and 56 patients, respectively. Skin rash was more frequent in DF, occurring in 119 patients compared

with 49 in DHF (p<0.001), whereas vomiting was more common in DHF, affecting 119 patients compared with 49 in DF (p=0.001). Hepatomegaly was also markedly more frequent among DHF patients (103 vs. 21; p=0.002). Features indicating severe disease, including low

urine output (119 vs. 0), low pulse volume (175 vs. 14) and shock (168 vs. 0), were significantly more common in the DHF group (p=0.001, p=0.006 and p=0.001, respectively).

**Table II**  
Comparison of Clinical Characteristics Between Dengue Fever and Dengue Hemorrhagic Fever.

| Clinical characteristic  | Total (N=350) | DF (n=133) | DHF (n=217) | p value |
|--------------------------|---------------|------------|-------------|---------|
| Fever                    | 350 (100%)    | 133 (100%) | 217 (100%)  | —       |
| Duration of fever (days) | —             | 4.89       | 5.3         | 0.072   |
| Headache                 | 152           | 77         | 75          | 0.01    |
| Myalgia                  | 133           | 56         | 77          | 0.215   |
| Retro-orbital pain       | 63            | 35         | 28          | 0.002   |
| Lethargy                 | 56            | 35         | 21          | 0.01    |
| Arthralgia               | 70            | 37         | 33          | 0.021   |
| Pallor                   | 72            | 21         | 51          | 0.123   |
| Jaundice                 | 14            | 7          | 7           | 0.345   |
| Skin rash                | 168           | 119        | 49          | <0.001  |
| GIT symptoms             |               |            |             |         |
| Vomiting                 | 168           | 49         | 119         | 0.001   |
| Abdominal pain           | 49            | 35         | 14          | 0.021   |
| Diarrhea                 | 49            | 7          | 42          | 0.123   |
| Ascites                  | 7             | 0          | 7           | 0.345   |
| Hepatomegaly             | 124           | 21         | 103         | 0.002   |
| Unconsciousness          | 14            | 0          | 14          | 0.019   |
| Convulsion               | 16            | 7          | 9           | 0.345   |
| Respiratory symptoms     | 294           | 133        | 161         | 0.002   |
| Urine output             |               |            |             |         |
| Normal                   | 231           | 133        | 98          | 0.001   |
| Low                      | 119           | 0          | 119         | —       |
| Pulse                    |               |            |             |         |
| <60/min                  | 175           | 126        | 49          | 0.002   |
| Low pulse volume         | 189           | 14         | 175         | 0.006   |
| Shock                    | 168           | 0          | 168         | 0.001   |

Table III shows the comparison of hematological characteristics between DF and DHF. Raised hematocrit (>48) was observed in 262 patients, including 78 with DF and 184 with DHF and was significantly

associated with DHF ( $p<0.004$ ). Leukopenia ( $<4 \times 10^3$  cells/ $\mu$ L) was found in 266 patients, with 84 in the DF group and 182 in the DHF group ( $p<0.001$ ). Thrombocytopenia ( $<150 \times 10^3$  cells/ $\mu$ L)

was also considerably more frequent among DHF patients, affecting 210 patients compared with 50 patients with DF ( $p<0.001$ ).

**Table III**  
Comparison of Hematological Characteristics Between Dengue Fever and Dengue Hemorrhagic Fever.

| Hematological parameter                               | Total (N=350) | DF (n=133) | DHF (n=217) | p value |
|-------------------------------------------------------|---------------|------------|-------------|---------|
| Raised hematocrit (>48)                               | 262           | 78         | 184         | <0.004  |
| Leukopenia ( $<4 \times 10^3$ cells/ $\mu$ L)         | 266           | 84         | 182         | <0.001  |
| Thrombocytopenia ( $<150 \times 10^3$ cells/ $\mu$ L) | 260           | 50         | 210         | <0.001  |

Table IV shows the comparison of biochemical characteristics between DF and DHF. Elevated ALT was found in 220 patients, including 80 with DF and 140 with

DHF, with a significant difference between the groups ( $p<0.001$ ). Similarly, elevated AST was observed in 273 patients, comprising 77 DF and 196 DHF patients

and the difference was statistically significant ( $p<0.001$ ).

**Table IV**  
Comparison of Biochemical Characteristics Between Dengue Fever and Dengue Hemorrhagic Fever.

| Biochemical parameter | Total (N=350) | DF (n=133) | DHF (n=217) | p value |
|-----------------------|---------------|------------|-------------|---------|
| Elevated ALT          | 220           | 80         | 140         | <0.001  |
| Elevated AST          | 273           | 77         | 196         | <0.001  |

**DISCUSSION**

The present study demonstrated clear differences in the clinical and hematological characteristics of children with DF and DHF, with several features being significantly more frequent among those with DHF. Of the 350 children, 133 (38%) had DF and 217 (62%) had DHF. This predominance of DHF is consistent with the changing clinical spectrum of pediatric dengue reported in recent studies. Akram et al. reported significant differences in clinical and biochemical parameters between DF and DHF during a recent

dengue outbreak, emphasizing the importance of early identification of severe disease [13]. Similarly, Idrus et al. found that several warning signs and laboratory abnormalities were more prominent among children with severe dengue [14]. In the present study, vomiting was substantially more common among children with DHF than DF (119 vs. 49;  $p=0.001$ ), while hepatomegaly was also markedly higher in DHF (103 vs. 21;  $p=0.002$ ). Low urine output, low pulse volume and shock were predominantly observed in the DHF group, with shock occurring in 168 DHF

patients compared with none of the DF patients ( $p=0.001$ ). These findings are clinically important because persistent vomiting, abdominal or gastrointestinal symptoms, hepatomegaly and circulatory abnormalities are recognized indicators of progression toward severe dengue. Singhi et al. emphasized that plasma leakage and circulatory compromise are major determinants of severe dengue in children and require close monitoring and timely intervention [15]. Pothapregada et al. also highlighted the importance of clinical

warning signs in identifying pediatric patients at risk of severe disease <sup>[16]</sup>.

Skin rash showed an opposite pattern in our study, being more frequent among DF patients (119 vs. 49;  $p < 0.001$ ). Headache, retro-orbital pain and lethargy were also observed, although their distribution differed between the two groups. These findings suggest that uncomplicated dengue may present with more characteristic febrile symptoms, whereas DHF is more likely to be accompanied by manifestations of systemic involvement and plasma leakage. Chen et al. similarly reported differences in clinical manifestations between DF and DHF, particularly in relation to bleeding tendency and disease severity <sup>[17]</sup>.

The hematological findings further supported the clinical distinction between the two groups. Leukopenia was found in 266 patients, including 84 with DF and 182 with DHF ( $p < 0.001$ ), while thrombocytopenia was present in 260 patients, with 50 DF and 210 DHF patients ( $p < 0.001$ ). Raised hematocrit was also significantly associated with DHF ( $p < 0.004$ ). These findings are consistent with Ferede et al., who demonstrated that leukopenia, thrombocytopenia and hematocrit changes provide useful information regarding dengue severity <sup>[18]</sup>. Islam et al. also described characteristic hematological abnormalities among children with dengue, supporting the value of serial blood count monitoring in pediatric cases <sup>[19]</sup>. A rise in hematocrit is particularly relevant because it may reflect plasma leakage, a defining feature of severe dengue. Biochemical abnormalities were also significantly more frequent among DHF patients. Elevated ALT was observed in 220 children, including 80 with DF and 140 with DHF ( $p < 0.001$ ), while elevated AST was found in 273 children, comprising 77 DF and 196 DHF patients ( $p < 0.001$ ). Prasad et al. reported that hepatic dysfunction is common in pediatric dengue and that greater liver enzyme abnormalities may accompany more severe disease <sup>[20]</sup>. Yang et al. similarly demonstrated associations between biochemical markers and severe dengue in a hospital-based study <sup>[21]</sup>.

## LIMITATIONS

This study had some limitations. It was conducted in a hospital-based pediatric population, which may limit the generalizability of the findings to children managed in other healthcare settings. The study also focused on selected clinical, hematological and biochemical parameters, while other factors that may influence dengue severity were not assessed. In addition, the relatively short study period may not fully reflect variations in dengue presentation across different outbreaks.

## CONCLUSION

DHF was associated with more severe clinical and laboratory abnormalities than DF among pediatric patients. Vomiting, hepatomegaly, reduced urine output, low pulse volume, shock, leukopenia, thrombocytopenia and elevated ALT and AST were significantly more common among children with DHF. Early recognition of these clinical and biochemical features may facilitate timely intervention and help reduce severe complications and mortality.

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## CONFLICTS OF INTEREST

There are no conflicts of interest.

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