

## COMPARISON OF CLINICAL AND LABORATORY PARAMETERS OF DENGUE AND SCRUB TYPHUS IN CHILDREN

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## ABSTRACT

**Background:** Dengue fever and scrub typhus are important causes of acute febrile illness in children and may present with overlapping clinical features, making early differentiation difficult. This study compared the clinical and laboratory parameters of dengue fever and scrub typhus in children and identified features that may aid early differentiation. **Materials and Methods:** This hospital-based prospective observational study was conducted among 80 children aged  $\leq 12$  years admitted to the Department of Paediatrics, Government Thiruvannamalai Medical College and Hospital, from October 2023 to June 2024. Forty children with serologically confirmed dengue fever and 40 with confirmed scrub typhus were included. Clinical features and laboratory parameters were recorded using a predefined proforma and compared using appropriate statistical tests. **Results:** Mean age was  $8.15 \pm 2.40$  years in dengue and  $7.35 \pm 3.08$  years in scrub typhus ( $p=0.43$ ). Fever duration was shorter in dengue ( $5.0 \pm 1.55$  vs.  $7.3 \pm 2.60$  days;  $p<0.0001$ ). Vomiting (67.5% vs. 42.5%), abdominal pain (50.0% vs. 25.0%), myalgia (35.0% vs. 7.5%), rash (22.5% vs. 2.5%), hypotension (25.0% vs. 5.0%), and hepatomegaly (42.5% vs. 22.5%) were more frequent in dengue. Dengue had lower leukocyte ( $3.85 \pm 1.87$  vs.  $9.42 \pm 4.30 \times 10^3/\mu\text{L}$ ) and platelet counts ( $85.60 \pm 48.05$  vs.  $139.0 \pm 107.5 \times 10^3/\mu\text{L}$ ), while scrub typhus showed higher ESR ( $42.93 \pm 16.86$  vs.  $30.18 \pm 10.72$  mm/h) and CRP positivity (50.0% vs. 10.0%). **Conclusion:** The most common presenting symptoms of children with dengue fever are fever, vomiting, abdominal pain and headache as compared to scrub typhus. Bleeding manifestations, oliguria, hypotension and hepatomegaly were also significantly higher in children with dengue fever. Significant difference was also observed in total leucocyte count, absolute neutrophil count, hematocrit, platelet count, ESR and SGPT level between the two groups.

## INTRODUCTION

Fever in children is one of the most common reasons for hospital visits in tropical countries such as India. Dengue fever and scrub typhus are two important causes of febrile illness in children. Both diseases are transmitted by vectors mosquitoes in dengue and mite larvae in scrub typhus and their clinical features may be very similar, especially during the early stage of illness.<sup>[1]</sup>

Dengue has been rising sharply worldwide. In 2024, WHO received reports of over 14 million dengue cases globally, including more than 52,000 severe

cases and over 11,000 deaths, marking the highest global dengue burden ever recorded.<sup>[1]</sup> Most children infected with dengue virus develop a mild illness, commonly presenting with fever, headache, retro-orbital pain, myalgia, nausea, vomiting and rash.<sup>[2]</sup> However, some children may progress to severe dengue, with complications such as plasma leakage, bleeding and organ involvement, which can be fatal if not recognized and treated promptly.<sup>[3]</sup> Climate change, expansion of mosquito habitats and changes in circulating viral serotypes have contributed to the increasing frequency and size of dengue outbreaks in recent years.<sup>[4]</sup>

Scrub typhus, caused by the bacterium *Orientia tsutsugamushi* and transmitted through the bite of infected chigger mites, has also emerged as an important cause of acute undifferentiated fever in India.<sup>[5]</sup> A nationwide systematic review found that scrub typhus accounts for at least 25.3% of all acute undifferentiated febrile illness cases in the country.<sup>[6]</sup> India lies within the so-called “tsutsugamushi triangle”, making scrub typhus an important endemic infection.<sup>[7]</sup> Children with scrub typhus commonly present with fever, headache, myalgia and, in some cases, an eschar at the site of the mite bite. They may also develop hepatosplenomegaly and thrombocytopenia.<sup>[8]</sup> If left untreated, scrub typhus can progress to complications such as multiple organ dysfunction and death.<sup>[9]</sup>

Dengue and scrub typhus together account for a substantial proportion of undifferentiated febrile illnesses in southern India, where the warm and humid climate favours the survival and transmission of both vectors.<sup>[10]</sup> However, the clinical features of the two infections often overlap, making early differentiation difficult based on clinical presentation alone. This is clinically important because their management differs considerably. Dengue is managed mainly with careful fluid management and supportive care, whereas scrub typhus requires specific antibiotic treatment. Therefore, early recognition and differentiation of dengue fever from scrub typhus are important for timely treatment and may improve clinical outcomes.

This study aimed to compare the clinical features and laboratory parameters of dengue fever and scrub typhus in children and to identify clinical and laboratory parameters that may help in the early differentiation of these two illnesses.

#### **Aim & Objectives**

- To compare the clinical features and laboratory parameters of dengue and scrub typhus in children.
- To identify clinical and laboratory parameters that may aid in the early differentiation of dengue fever and scrub typhus in children.

## **MATERIALS AND METHODS**

This hospital-based prospective observational study was conducted in the Department of Paediatrics, Government Tiruvannamalai Medical College and Hospital, Tiruvannamalai, over a period of 9 months from October 2023 to June 2024. The study included 80 children aged  $\leq 12$  years admitted to the children's ward, comprising 40 children with dengue fever and 40 with scrub typhus. Institutional Ethical Committee approval was obtained from the Institutional Ethics Committee of Government Tiruvannamalai Medical College, Tiruvannamalai (IEC Protocol No. 55/IEC/2023; approval date: 27 September 2023) before commencement of the study.

#### **Inclusion Criteria**

Children aged  $\leq 12$  years with confirmed dengue infection based on dengue IgM capture ELISA (Panbio) and/or NS1 antigen detection, or confirmed scrub typhus based on IgM serology, were included.

#### **Exclusion Criteria**

Children aged  $\leq 12$  years who were negative for dengue IgM, NS1 antigen and scrub typhus IgM were excluded. Children with serological evidence of dengue and/or scrub typhus with other comorbid conditions were also excluded.

#### **Sample size calculation**

The sample size was calculated using OpenEpi software based on a previous study by Elangovan and Rajesh.<sup>10</sup> The mean hemoglobin values of 13.3 g/dL in the dengue group and 12.2 g/dL in the scrub typhus group were considered, with 80% power and a 95% confidence level. The calculated sample size was 72, which was rounded to 80 to ensure adequate recruitment, with 40 children enrolled in each group.

#### **Sampling method**

Purposive sampling, a non-probability sampling method, was used. Children aged  $\leq 12$  years admitted to the paediatric ward with fever who were serologically confirmed to have dengue fever or scrub typhus and fulfilled the eligibility criteria were enrolled. A total of 80 children were included, with 40 children in each group. Data on clinical and laboratory parameters were collected using a predefined proforma and compared between the two groups.

#### **Methods**

Eligible children admitted with fever were enrolled using a purposive sampling method. After obtaining informed consent from parents, demographic details including age & gender were recorded using a predefined proforma. Clinical details including duration of fever, vomiting, rash, myalgia, headache/periorbital pain, abdominal pain, bleeding manifestations, difficulty in breathing and decreased urine output were documented. Bleeding manifestations were recorded when clinically evident bleeding, including epistaxis, gum bleeding, hematemesis, melena, hematuria or other overt bleeding, was present. General examination, vital signs and systemic examination were performed, including assessment for rash, eschar, hypotension, hepatomegaly and splenomegaly. Urine output was monitored.

Laboratory investigations included complete blood count comprising hemoglobin, hematocrit, total leukocyte count, absolute neutrophil count and platelet count, along with ESR, CRP and liver function tests, including SGPT. CRP was classified as positive according to the laboratory-specific reference cut-off used for the assay. Appropriate treatment was initiated without delay, and children were followed until recovery and discharge.

#### **Operational definitions**

Oliguria was defined as urine output  $< 1$  mL/kg/day. Hypotension was defined according to age-specific systolic blood pressure criteria:  $< 60$  mmHg in

neonates (0–28 days), <70 mmHg in infants (1–12 months), <70 + (age in years × 2) mmHg in children aged 1–10 years, and <90 mmHg in children older than 10 years.

### Statistical Analysis

Continuous variables were assessed for normality using the Shapiro–Wilk test and expressed as mean ± standard deviation. Normally distributed variables were compared using the unpaired Student's t-test, while non-normally distributed variables were compared using the Mann–Whitney U test. Categorical variables were expressed as frequencies

and percentages and compared using the chi-square test or Fisher's exact test, as appropriate. A two-tailed p-value <0.05 was considered statistically significant.

## RESULTS

The study included 80 children, 40 each with dengue and scrub typhus. Mean age was  $8.15 \pm 2.40$  and  $7.35 \pm 3.08$  years. Males comprised 23 (57.5%) and 20 (50.0%). [Table 1]

**Table 1: Baseline characteristics of study participants**

| Variable               | Dengue (n=40)   | Scrub typhus (n=40) | p-value |
|------------------------|-----------------|---------------------|---------|
| Age, mean ± SD (years) | $8.15 \pm 2.40$ | $7.35 \pm 3.08$     | 0.43    |
| Male, n (%)            | 23 (57.5%)      | 20 (50.0%)          | 0.5     |
| Female, n (%)          | 17 (42.5%)      | 20 (50.0%)          |         |

Mean fever duration was  $5.0 \pm 1.55$  days in dengue and  $7.3 \pm 2.60$  days in scrub typhus ( $p < 0.0001$ ). Vomiting, abdominal pain, headache/periorbital pain, myalgia, and rash were reported in 27 (67.5%), 20 (50.0%), 15 (37.5%), 14 (35.0%), and 9 (22.5%) dengue cases compared with 17 (42.5%), 10 (25.0%), 7 (17.5%), 3 (7.5%), and 1 (2.5%) scrub typhus cases, respectively. Oliguria, bleeding manifestations, hypotension, and hepatomegaly were present in 11

(27.5%), 7 (17.5%), 10 (25.0%), and 17 (42.5%) dengue cases compared with 4 (10.0%), 0, 2 (5.0%), and 9 (22.5%) scrub typhus cases, respectively. Splenomegaly was present in 7 (17.5%) scrub typhus cases and none with dengue, while eschar was present in 13 (32.5%) scrub typhus cases. Difficulty in breathing occurred in 5 (12.5%) dengue and 3 (7.5%) scrub typhus cases ( $p = 0.456$ ). [Table 2]

**Table 2: Comparison of clinical characteristics**

| Clinical parameter                  | Dengue (n=40)  | Scrub typhus (n=40) | p-value |
|-------------------------------------|----------------|---------------------|---------|
| Duration of fever (days), mean ± SD | $5.0 \pm 1.55$ | $7.3 \pm 2.60$      | <0.0001 |
| Vomiting, n (%)                     | 27 (67.5%)     | 17 (42.5%)          | 0.02    |
| Abdominal pain, n (%)               | 20 (50.0%)     | 10 (25.0%)          | 0.02    |
| Headache/periorbital pain, n (%)    | 15 (37.5%)     | 7 (17.5%)           | 0.045   |
| Myalgia, n (%)                      | 14 (35.0%)     | 3 (7.5%)            | 0.003   |
| Rash, n (%)                         | 9 (22.5%)      | 1 (2.5%)            | 0.007   |
| Oliguria, n (%)                     | 11 (27.5%)     | 4 (10.0%)           | 0.045   |
| Bleeding manifestations, n (%)      | 7 (17.5%)      | 0                   | 0.0056* |
| Difficulty in breathing, n (%)      | 5 (12.5%)      | 3 (7.5%)            | 0.456   |
| Hypotension, n (%)                  | 10 (25.0%)     | 2 (5.0%)            | 0.012   |
| Hepatomegaly, n (%)                 | 17 (42.5%)     | 9 (22.5%)           | 0.0373  |
| Splenomegaly, n (%)                 | 0              | 7 (17.5%)           | 0.0056* |
| Eschar, n (%)                       | —              | 13 (32.5%)          | —       |

Mean hemoglobin was  $12.03 \pm 1.76$  g/dL in dengue and  $11.15 \pm 1.56$  g/dL in scrub typhus ( $p = 0.02$ ), while mean hematocrit was  $38.59 \pm 5.97\%$  and  $35.09 \pm 4.58\%$ , respectively ( $p = 0.004$ ). Mean total leukocyte count was  $3.85 \pm 1.87$  and  $9.42 \pm 4.30 \times 10^3/\mu\text{L}$

( $p < 0.0001$ ), and mean absolute neutrophil count was  $2.18 \pm 1.66$  and  $5.73 \pm 3.02 \times 10^3/\mu\text{L}$  ( $p < 0.0001$ ), respectively. Mean platelet count was  $85.60 \pm 48.05$  and  $139.0 \pm 107.5 \times 10^3/\mu\text{L}$  ( $p = 0.03$ ). [Table 3]

**Table 3: Comparison of hematological parameters**

| Laboratory parameter                                    | Dengue (n=40)     | Scrub typhus (n=40) | p-value |
|---------------------------------------------------------|-------------------|---------------------|---------|
| Hemoglobin (g/dL)                                       | $12.03 \pm 1.76$  | $11.15 \pm 1.56$    | 0.02    |
| Hematocrit (%)                                          | $38.59 \pm 5.97$  | $35.09 \pm 4.58$    | 0.004   |
| Total leukocyte count ( $\times 10^3/\mu\text{L}$ )     | $3.85 \pm 1.87$   | $9.42 \pm 4.30$     | <0.0001 |
| Absolute neutrophil count ( $\times 10^3/\mu\text{L}$ ) | $2.18 \pm 1.66$   | $5.73 \pm 3.02$     | <0.0001 |
| Platelet count ( $\times 10^3/\mu\text{L}$ )            | $85.60 \pm 48.05$ | $139.0 \pm 107.5$   | 0.03    |

Mean SGPT was  $96.45 \pm 87.87$  vs  $48.00 \pm 39.73$  IU/L and ESR was  $30.18 \pm 10.72$  vs  $42.93 \pm 16.86$  mm/h in dengue and scrub typhus groups. CRP was positive

in 4 (10.0%) children with dengue and 20 (50.0%) with scrub typhus. [Table 4]

**Table 4: Comparison of biochemical and inflammatory parameters**

| Parameter           | Dengue (n=40) | Scrub typhus (n=40) | p-value |
|---------------------|---------------|---------------------|---------|
| SGPT (IU/L)         | 96.45 ± 87.87 | 48.00 ± 39.73       | 0.018   |
| ESR (mm/h)          | 30.18 ± 10.72 | 42.93 ± 16.86       | 0.0001  |
| CRP positive, n (%) | 4 (10.0%)     | 20 (50.0%)          | <0.0001 |

## DISCUSSION

In our study, the mean age of children with dengue fever was  $8.15 \pm 2.40$  years, which was comparable to the  $7.97 \pm 3.8$  years reported by Elangovan and Rajesh.<sup>10</sup> Similar mean ages were reported by Mishra et al.<sup>11</sup> (7 years) and Srinivasa et al.<sup>[12]</sup> (8.2 years). Among children with scrub typhus, the mean age was  $7.35 \pm 3.08$  years, comparable to the 8.8 years reported by Kumar Bhat et al.<sup>[13]</sup>

The male-to-female ratio was 1.35:1 among children with dengue fever and 1:1 among those with scrub typhus, with no statistically significant difference between the groups ( $p=0.5$ ). Consistent with our findings, Elangovan and Rajesh.<sup>[10]</sup> found no significant difference in sex distribution, with male-to-female ratios of 1.1:1 in dengue fever and 2.2:1 in scrub typhus ( $p>0.05$ ). Other studies have reported a slight male predominance among children with dengue, with male-to-female ratios of 1.2:1 in the study by Pothapregada et al.<sup>[14]</sup> and 1.9:1 in the study by Srinivasa K et al.<sup>[12]</sup>

The mean duration of fever was significantly longer in children with scrub typhus ( $7.3 \pm 2.6$  days) than in those with dengue fever ( $5.0 \pm 1.55$  days;  $p<0.0001$ ). This finding was consistent with the observations of Elangovan and Rajesh.,<sup>10</sup> who reported a mean fever duration of  $7.34 \pm 2.46$  days in children with scrub typhus compared with  $4.5 \pm 1.13$  days in those with dengue fever ( $p<0.0001$ ).

Vomiting, abdominal pain, oliguria and bleeding manifestations were observed in 67.5%, 50%, 27.5% and 17.5% of children with dengue fever, respectively, compared with 42.5%, 25%, 10% and 0% of children with scrub typhus. The differences were significant ( $p<0.05$ ). Elangovan and Rajesh. similarly reported a higher frequency of these manifestations among children with dengue fever, with vomiting, abdominal pain, oliguria and bleeding occurring in 77.5%, 67.5%, 57.5% and 42.5% of dengue cases, compared with 4.38%, 34.4%, 9.4% and 6.3% of scrub typhus cases.<sup>[10]</sup>

The predominant symptoms in children with scrub typhus, apart from fever, were vomiting (42.5%), abdominal pain (25%) and headache/periorbital pain (17.5%) in the present study. These findings were broadly comparable with those reported by Kumar Bhat et al.<sup>[13]</sup> who observed vomiting in 56%, abdominal pain in 33% and headache in 18% of children, and by Narayanasamy et al., who reported vomiting in 68%, headache in 45% and abdominal pain in 42% of children with scrub typhus.<sup>[15]</sup>

Among children with dengue fever, the predominant symptoms in the present study were vomiting (67.5%), abdominal pain (50%), headache/periorbital pain (37.5%), myalgia (35%) and oliguria (27.5%).

These findings were comparable with those reported by Srinivasa K et al., who documented vomiting (61.6%), abdominal pain (50.2%), myalgia (24.3%) and bleeding manifestations (16.2%) among hospitalized children with dengue fever.<sup>[12]</sup>

Rash was observed in 22.5% of children with dengue fever compared with 2.5% of those with scrub typhus ( $p=0.007$ ). This was comparable to the 30.2% reported by Srinivasa K et al.<sup>[12]</sup> However, Rajesh NT et al. found erythematous rash in 15% of children with severe dengue and 15.6% with scrub typhus, with no significant difference ( $p=0.14$ ).<sup>[10]</sup> Thus, rash may aid differentiation between dengue and scrub typhus, although its diagnostic value may vary across populations.

Hypotension was present in 25% of dengue cases and 5% of scrub typhus cases, while hepatomegaly was present in 42.5% and 22.5%, respectively. Splenomegaly was present in 17.5% of scrub typhus cases and was absent in dengue fever. These differences were significant ( $p=0.012$ ,  $p=0.0373$  and  $p=0.0056$ ). Hypotension and hepatomegaly in dengue fever were also comparable with findings reported by Pothapregada S et al.<sup>[14]</sup> Mishra et al.<sup>[11]</sup> and Srinivasa K et al.<sup>[12]</sup> Splenomegaly was predominantly observed in scrub typhus in our study. Eschar was present in 13 (32.5%) children with scrub typhus, which was comparable to the 34.6% reported by Arun Babu et al.<sup>16</sup> Bleeding manifestations were present in 17.5% of children with dengue fever, comparable to findings reported by Pothapregada et al. (19.9%),<sup>[14]</sup> and Srinivasa et al. (16.2%).<sup>[12]</sup>

Mean hemoglobin and hematocrit were  $12.03 \pm 1.76$  g/dL and  $38.59 \pm 5.97\%$  in dengue fever, compared with  $11.15 \pm 1.56$  g/dL and  $35.09 \pm 4.58\%$  in scrub typhus. The differences were statistically significant ( $p<0.05$ ). Similar findings were reported by Elangovan and Rajesh., who observed mean hemoglobin and hematocrit values of  $13.3 \pm 1.70$  g/dL and  $41.45 \pm 5.78\%$ , respectively, in dengue fever and  $12.24 \pm 1.63$  g/dL and  $37.6 \pm 5.14\%$ , respectively, in scrub typhus.<sup>[10]</sup>

Mean total leukocyte count, absolute neutrophil count and platelet count were lower in dengue fever ( $3.85 \pm 1.87$ ,  $2.18 \pm 1.66$  and  $85.60 \pm 48.05 \times 10^3/\mu\text{L}$ , respectively) than in scrub typhus ( $9.42 \pm 4.30$ ,  $5.73 \pm 3.02$  and  $139.0 \pm 107.5 \times 10^3/\mu\text{L}$ , respectively), with statistically significant differences ( $p<0.05$ ). Similar differences were reported by Elangovan and Rajesh., who observed total leukocyte count, absolute neutrophil count and platelet count of  $5.19 \pm 3.03$ ,  $2.6 \pm 1.97$  and  $50.23 \pm 35.55 \times 10^3/\mu\text{L}$ , respectively, in dengue fever and  $7.64 \pm 3.45$ ,  $3.9 \pm 2.06$  and  $140 \pm 95.0 \times 10^3/\mu\text{L}$ , in scrub typhus.<sup>[10]</sup>

In our study, the mean ESR at 1 hr was lower in children with dengue fever ( $30.18 \pm 10.72$  mm) when

compared to scrub typhus ( $42.93 \pm 16.86$  mm) and this difference was statistically significant ( $p < 0.05$ ). Similar finding was also observed in a Elangovan and Rajesh study with a 75 statistically significant difference ( $p < 0.05$ ) in mean ESR between dengue fever ( $8.1 \pm 6.82$  mm) and scrub typhus group ( $33.88 \pm 13.79$ ).<sup>[10]</sup>

Overall, dengue fever showed a shorter fever duration and higher frequencies of vomiting, abdominal pain, myalgia, rash, hypotension, hepatomegaly and bleeding, with higher hemoglobin, hematocrit and SGPT and lower leukocyte, neutrophil and platelet counts. Scrub typhus was characterised by longer fever duration, splenomegaly, eschar, and higher leukocyte count, ESR and CRP positivity. These differences may aid early clinical differentiation between the two illnesses.

## CONCLUSION

Dengue and scrub typhus showed several differences in their clinical and laboratory profiles. Dengue was associated with shorter fever duration, more vomiting, abdominal pain, rash, bleeding, hypotension, and lower platelet and leukocyte counts. Scrub typhus showed longer fever, splenomegaly, eschar, higher leukocyte counts, ESR, and CRP positivity. These findings may help clinicians differentiate the two infections early and guide timely management.

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