

# Dengue Infection in Teenage Children

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## Abstract

To determine the magnitude of problem of dengue infections in teenage children and distinctive clinical clues that differ from those in younger children, 995 serologically proven children diagnosed as dengue infection and admitted to the Department of Pediatrics, Chulalongkorn Hospital from 1988 to 1995 were reviewed. One hundred and forty-three cases (14.4%) were 13-15 years old. Of these 66 were males and 77 were females. Five leading clinical manifestations were fever (100%), vomiting (74.8%), hepatomegaly (72%), anorexia (67.8%) and abdominal pain (51.7%). The average duration of fever before admission was 4.6 days. Diagnosis was categorized into dengue fever (4.2%), dengue hemorrhagic fever (52.4%) and dengue shock syndrome (43.4%). Common sites of bleeding were skin (44.1%), mucous membrane (18.9%) and gastrointestinal tract (20.3%). The majority of cases (97.8%) had secondary infection. One patient died. Compared to the control group (n = 143), teenage children with dengue infections presented more commonly with headache and less commonly with drowsiness ( $p < 0.05$ ). The maximal hematocrit values were significantly higher in the study group whereas white blood cell counts were significantly lower ( $p < 0.05$ ). This study emphasizes the significance of dengue infections in teenage children. Clinical manifestations and laboratory findings are not much different from those in younger children. (*J Infect Dis Antimicrob Agents* 2000;17:93-6.)

## INTRODUCTION

Dengue infection is one of the major public health problem of children in Southeast Asian and Western Pacific regions.<sup>1</sup> The etiological agents include four dengue serotypes and the principal vector is the mosquito *Aedes aegypti*. In the past decade, a trend of increasing age in dengue patients was evident.<sup>2</sup> Moreover, clinical presentations and laboratory findings of dengue infections may be different in each age group.<sup>3</sup> So we conducted this study in order to reveal the magnitude of problem and the natural history of dengue infection in teenage children and to compare with those in younger children in terms of clinical presentation, laboratory findings, complications and outcomes. The data may

be beneficial for internists in caring for adolescents and adults with dengue infections.

## MATERIALS AND METHODS

### Study design

This descriptive study was conducted in the Department of Pediatrics, Chulalongkorn Hospital between January 1988 and December 1995.

### Study and comparative subjects

All hospitalized children aged from 13-15 years and diagnosed as dengue infection, were reviewed from prospectively recorded dengue medical charts. Diagnosis of dengue infection included clinical

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diagnosis and serological diagnosis using enzyme-linked immunosorbent assay (ELISA) or hemagglutination-inhibition (HI) tests. Comparative subjects were children aged 0-12 years, who were diagnosed as dengue infection and were sampled by stratified sampling method for each year of study in the ratio of one to one.

### Data collection

Data collection from medical records were age, sex, date of hospitalization, severity of disease, clinical presentations, laboratory findings, complications and outcome.

### Data analysis

Descriptive data were analyzed using mean, range and percentage. Variables were compared by Chi-square test and Student *t*-test. The level of significance was set at the *p*-value of < 0.05.

## RESULTS

Of 995 serologically proven children 0-15 years of age with dengue infections, 143 were teenage children accounting for 14.4 percent. There were 66 males and 77 females. The median age was 13.5 years. Of 143 patients in the control group, 85 were boys and 58 were girls. The average age was 7.3 years.

In the study group, almost all patients had fever with an average duration of 4.6 days prior to admission. The top eight common symptoms and signs included vomiting (74.6%), hepatomegaly (72.0%), decreased appetite (67.8%), abdominal pain (51.7%), coryza (36.4%), drowsiness (25.2%), headache (23.1%) and diarrhea (21.7%). Common bleeding sites included skin (44.1%), gastrointestinal system (20.3%) and mucous membranes (18.9%). Approximately 3.5 percent of patients had unusual neurological manifestations.

According to the World Health Organization classification, the patients were categorized into dengue fever (4.2%), dengue hemorrhagic fever (52.4%) and dengue shock syndrome (43.4%). Ninety-eight percent of the study patients were serologically proven as secondary dengue infection. The mortality rate was 0.7 percent.

The mean maximal hematocrit value (Hct max) was 46.9 percent with the range of 31-60 percent. The mean differences between maximal and minimal

hematocrit value ( $\Delta$ Hct) was 8.1 percent with the range of 0-33 percent. The mean minimal value of white blood cell (wbc min) count was 4,243 cells/mm<sup>3</sup> and 3.5 percent of patients had wbc count of 10,000 cells/mm<sup>3</sup> or more. The mean maximal percentage of neutrophils, lymphocytes and atypical lymphocytes were 56.5, 39.3 and 9.4 percent respectively, with the range of 18-94, 12-76 and 0-51 percent respectively. The mean minimal value of platelet count was 92,727/mm<sup>3</sup> with the range of 11,000-862,000/mm<sup>3</sup>. Forty-two and 12 percent of cases had the minimal value of platelet count 50,000/mm<sup>3</sup> or less and 20,000/mm<sup>3</sup> or less respectively.

The mean minimal serum sodium (Na min) value was 136.2 mEq/L with the range of 124-147 mEq/L. Nine percent of patients had minimal serum sodium 130 mEq/L or less (hyponatremia).

Comparing with controls, dengue teenagers presented more commonly with headache and presented less commonly with drowsiness (Table 1). Sites of bleeding were not different between both groups (Table 2). Considering laboratory findings, it was found that Hct max was significantly higher whereas wbc min was significantly lower in the study group (Table 3). Clinical categorization was not different (Table 4).

**Table 1. Symptoms and signs of teenage and control patients.**

Symptoms and Signs	Teenager (n = 143) n (%)	Control Group (n = 143) n (%)	n-value
1. Days of fever prior to admission	4.6 days	4.6 days	NS
2. Vomiting	107 (74.8)	107 (74.8)	NS
3. Hepatomegaly	103 (72.0)	113 (79.0)	NS
4. Decreased appetite	97 (67.8)	87 (60.8)	NS
5. Abdominal pain	74 (51.7)	58 (40.6)	NS
6. Coryza	52 (36.4)	65 (45.5)	NS
7. Drowsiness	36 (25.2)	52 (36.4)	0.04
8. Headache	33 (23.1)	17 (11.9)	0.01
9. Diarrhea	31 (21.7)	30 (21.0)	NS
10. Rash	23 (16.1)	24 (16.8)	NS
11. Myalgia	9 (6.3)	7 (4.9)	NS
12. Conjunctivitis	8 (5.6)	10 (7.0)	NS
13. Convulsion	1 (0.7)	6 (4.2)	NS

NS = no statistical significance

**Table 2. Sites of bleeding in teenage and control patients.**

Sites	Teenager (n = 143) n (%)	Control Group (n = 143) n (%)	p-value
Skin	63 (44.1)	47 (32.9)	NS
Gastrointestinal system	29 (20.3)	20 (14.0)	NS
Mucous membrane	27 (18.9)	31 (21.7)	NS

NS = no statistical significance

**Table 3. Complete blood count and serum sodium in teenage and control patients.**

	Teenager (n = 143)	Control Group (n = 143)	p-value
Hct max (%)	46.8	43.6	0.000
$\Delta$ Hct (%)	8.1	8.4	NS
Wbc min (cells/mm <sup>3</sup> )	4,243.0	6,425.0	0.000
% PMN max	56.5	53.8	NS
% L max	39.3	41.7	NS
% AL max	9.4	10.7	NS
Platelet min (/mm <sup>3</sup> )	92,727.0	99,862.0	NS
Na min (mEq/L)	136.2	135.0	NS

Hct = hematocrit, max = maximum,  $\Delta$  = differences between maximal and minimal hematocrit, min = minimum, mm<sup>3</sup> = cubic millimeter, PMN = polymorphonuclear cell, L = lymphocyte, AL = atypical lymphocyte, Na = sodium, mEq/L = milliequivalent per liter, NS = no statistical significance

**Table 4. Clinical diagnosis, serological diagnosis and outcome of teenage and control patients.**

	Teenager (n = 143) n (%)	Control Group (n = 143) n (%)	p-value
Clinical diagnosis			
Dengue fever	6 (4.2)	10 (7.0)	NS
Dengue hemorrhagic fever			
Grade I	19 (13.3)	18 (12.6)	NS
Grade II	56 (39.2)	47 (32.9)	NS
Grade III	57 (39.9)	67 (46.9)	NS
Grade IV	5 (3.5)	1 (0.7)	NS
Serological diagnosis			
Primary infection	3 (2.1)	42 (29.4)	0.000
Secondary infection	140 (97.9)	101 (70.6)	
Mortality rate	1 (0.7)	0	NS

NS = no statistical significance

## DISCUSSION

This study showed that teenage children with dengue infections accounted for 14 percent of all dengue pediatric patients whose age was below 15 years old.

Five leading clinical manifestations including fever, vomiting, hepatomegaly, anorexia and abdominal pain, were not different from controls and results from a previous report.<sup>4</sup> It is more likely that older children will complain of headache when they are febrile. This may explain why teenage children with dengue infections manifested more commonly with headache. On the other hand, doctors and parents of younger children with dengue infections tend to notice symptom and sign of drowsiness more often, resulting in the finding that teenage children with dengue infections were less likely to be drowsy.

Three common sites of bleeding found in study patients were not different from that found in controls. However, hypermenorrhea with clinical significance was seen in some teenage girls with dengue infections. History taking concerning menstrual period is essential in all girls who present with clinical manifestations compatible with dengue infections. Hormonal therapy to stop the bleeding may be necessary.

Normally, older children tend to have higher hematocrit level and lower white blood cell count. This may explain why dengue teenagers had significantly higher average value of hematocrit and lower average value of white blood cell count. Moreover, the severity of plasma leakage may be more in older children resulting in higher hematocrit level. However, there was no supporting evidence. Dengue virus, one of the neutropenic viruses may affect more on the number of white blood cells of older children causing lower white blood cell counts. A previous study on the dynamic of white blood cells in dengue patients demonstrated that the number and types of white blood cells changed dynamically with dates of illnesses.<sup>5</sup> Studying the dynamic of these cells in different age groups of children may answer the hypothesis.

Our study showed that severity of dengue teenagers was not different from that of control. This is possible because the study was conducted only in hospitalized patients and there was actually more tendency to admit younger patients than older ones. In addition, almost all dengue teenagers were secon-

dary infections which tend to cause more serious diseases. However, there was no clinical significance according to the clinical categorization and mortality rate. In conclusion, this study emphasizes that dengue infections in teenage children is quite common. Clinical presentations and laboratory findings are not much different from those in younger children.

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