ROLE OF TOURNIQUET TEST IN DENGUE PATIENTS

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Abstract. The percentage of positive finding in tourniquet test studies in dengue patients has been reported to be between 70-83.9%. However, no data of the positive tourniquet test in relation to days of illness and days before defervescence exist. Thus, our study aimed to evaluate the diagnostic utility of the tourniquet test during the time course of the illness in dengue patients and associations between the tourniquet test result and severity of dengue infection, age, as well as thrombocytopenia. A prospective observational study was conducted in children and adults who were diagnosed as dengue infection hospitalized at King Chulalongkorn Memorial Hospital from December 1997 to December 1998. The tourniquet tests were performed on alternating arms daily until one positive result was obtained. We found the percentage of positive tourniquet tests increased by day of illness. There was no significant difference between tourniquet test result and either shock status or the presence of thrombocytopenia (<100,000/µl). This study reveals that age has no influence on the outcome of the tourniquet test. In conclusion, the tourniquet test is a simple and useful procedure to assist in diagnosis of dengue.

Keywords: dengue infection, tourniquet test

INTRODUCTION

Dengue infection is one of the most important diseases in Thailand and many countries in tropical areas. One of the largest outbreak was in 1987 with the total number of reported cases of 174,285 (Thisyakorn and Thisyakorn, 1994). The clinical features of dengue infection are variable from asymptomatic infection, dengue fever, dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS) (Thisyakorn and Thisyakorn, 1994). Early clinical diagnosis of dengue infection in the first few days of illness can be difficult because the signs and symptoms of dengue patients are similar to many other infectious diseases such as malaria, scrub typhus, influenza, and chikunkunya (Monath, 1995).

The tourniquet test, which is a simple procedure, is one of the most common hemorrhagic phenomenon of DHF and is one of the WHO clinical criteria for DHF diagnosis (WHO, 1997). It was first applied to the dengue diagnosis during the 1928 epidemic in Greece, an outbreak that is now thought to have been an early occurrence of DHF/DSS (Halstead, 1989). A previous study by Nimmannitya, in 1969 showed a percentage of positive tourniquet tests in dengue patient of 83.9% (Nimmannitya, 1997; WHO, 1997), and a study showed the specificity and sensitivity in dengue patients were 90% and 70%, respectively (Tham *et al*, 1996). However, there are no data that show the percentage of positive tourniquet tests by days of illness or days before defervescence.

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We, therefore, designed a prospective cohort study to evaluate the suitable time period for the diagnostic utility of the tourniquet test in dengue patients and to seek associations between positive tourniquet test result and shock status, the presence of thrombocytopenia and age.

MATERIALS AND METHODS

Study subjects

Eligible patients admitted to King Chulalongkorn Memorial Hospital at both adult and child wards. The inclusion criteria were patients who presented with fever equal to or more than 37.5°C or history of fever and having clinical suspicions of dengue infection. All the patients needed to have serologic confirmation of acute dengue infection by either enzymes immunosorbent assay (EIA) or hemagglutination inhibition (HI) test positive (WHO, 1997). Exclusion criteria were patient with fever from other infections, a contraindication to perform the tourniquet test, and intolerance of pain caused by tourniquet test.

Protocol

Tourniquet testing at admission was performed by inflating a blood pressure cuff on the upper arm mid-way between systolic and diastolic blood pressure for 5 minutes, followed by examination of a 2.5 cm^2 area using a standard template. The number of petechiae up to 20 within the template was counted. The tourniquet test was performed by the study investigators on alternating arms daily until the test became positive (WHO, 1997).

Definitions

We defined the first day of illness as the first day of fever and days were counted consecutively afterward. We defined day before defervescence as the number of days before the body temperature was less than 37.5°C. We used standard clinical grading of WHO criteria for the clinical definition of DHF cases (WHO, 1997).

Statistical analysis

The percentage of positive tourniquet test was shown by mean. We used chi-square analysis and Fisher's exact test for statistical analysis to find any associations between tourniquet test and shock status, presence of thrombocytopenia, as well as age. A *p*-value <0.05 was considered to be significant.

RESULTS

Sixty-six cases were enrolled: 19 adults and 47 children. The overall male to female ratio was 1:1 (males=33, females=33). The mean age (range) was 13.76 years (7 months-66 years). In the first six days of illness, the percentage of positive tourniquet tests increased rapidly. After that, there was only a slight increase. The overall positive tourniquet test percentage was 78.8% (Fig 1).

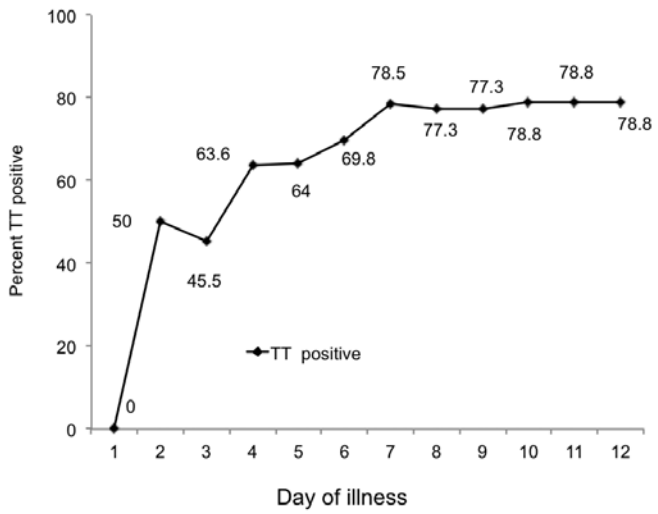

Fig 1–Percentage of positive tourniquet test in dengue patients by days of illness.

Comparing positive tourniquet test between children and adults indicated that the percentage of positive tourniquet tests in children were much higher than in adults in the first 4 days of illness (Fig 2). After that, the percentages were similar.

In addition, there were no significant associations between tourniquet test results and dengue infection severity (p=0.44), age (child or adult) (p=0.55) and thrombocytopenia (platelets <100 x 10^9/l) (p=0.77) (Table 1).

DISCUSSION

Our study was the first study to show the percentages of positive tourniquet test following the day of illness. After day 2 of illness, the percentage of positive tourniquet test markedly increased until the end of first of week. This may imply the suitable time period of diagnostic utility of tourniquet test in dengue infection. We found the percentage of positive tourniquet tests increased by day of illness and day before defervescence. Presence of shock, age, and thrombocytopenia had no significant difference on result of tourniquet test.

The diagnostic role of tourniquet test in dengue infection is still controversial. Recent studies have shown the low sensitivity of tourniquet test in diagnosis dengue infection. A meta-analysis (Grande *et al*, 2016) of 28,739 patients showed the pooled sensitivity and specificity for dengue

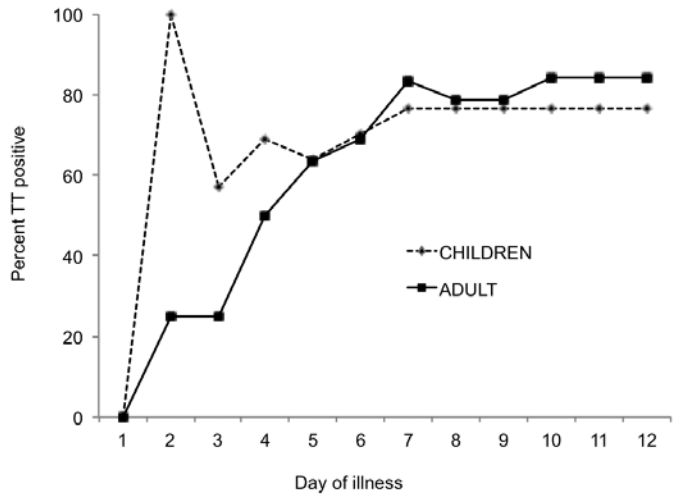

Fig 2- Percentage of positive tourniquet test between adults and children by days of illness.

Table 1. Comparison of percentage of positive tourniquet test between clinical severity, age, and platelet count.

Patient's status	Positive tourniquet test (%)	p-value
Shock *vs* non-shock	87.5 *vs* 77.5	NS
Children *vs* adult	76.7 *vs* 84.2	NS
Thrombocytopenia *vs* non-thrombocytopenia	75 *vs* 66	NS

NS, non significant.

diagnosis by tourniquet tests were only 58% and 71%, respectively. Of note, this study was mainly driven by retrospective study from Brazil (Antunes *et al*, 2013), *N* = 9,836, which did not mention time of tourniquet tests were performed.

Another study by Furlan *et al* (2016) of 28,000 dengue patients, found that tourniquet test had a sensitivity of only 11.9%. Again, this study did not mention time of tourniquet test and frequency of test. However, Cavailler *et al* (2016) tested the diagnostic utility of positive tourniquet test in predicting dengue infection and found the odds ratio at 2.17 (95% CI: 1.32-3.59). A study from Puerto Rico has shown the utility benefit of the combination of tourniquet test and white blood of cell count in differentiation of dengue infection from other acute febrile illnesses (Gregory *et al*, 2011). This mean that we should not use only one clinical test but use clinical combination to diagnose dengue infections.

Our study showed the presence of thrombocytopenia had no significant association to the result of the tourniquet test. The positive tourniquet test in dengue infection is not only from the presence of thrombocytopenia but also from other hemostatic factors such as vasculopathy and coagulopathy (Mitrakul, 1987). This means that a tourniquet test can be performed even when the platelet count is higher than 100,000/l.

This study, however, did not collect the daily complete blood count, so we selected the number of platelet counts by in groups when the tourniquet test was positive, we used the maximum number of platelet counts on the first day of positive test. In groups when the tourniquet test was negative, we used the minimum number of platelet counts on the last day of admission.

This study had some strengths. First, we used standard serology (EIA, HI) tests to confirm dengue infection in every case. Second, we have serially performed tourniquet tests until the test was positive, not only single time points. This will provide a better picture of tourniquet test during the time course of dengue infection.

Our study also had some limitations. We did not have the control group and could not demonstrate the sensitivity and specificity of tourniquet test in diagnosing dengue infection. However, as mention earlier, our study aimed to demonstrate the suitable time period to perform a tourniquet test, not the diagnostic accuracy. We also accept that this study was not designed to reveal the potential contributing factors to the result of tourniquet test. Therefore, a better study design to find out those contributing factors is needed.

In summary, we have shown the tourniquet test, a simple bedside procedure, provided a good diagnostic utility during the first week of dengue infection and should be combined with other clinical parameters to help diagnosis dengue suspected cases.

ACKNOWLEDGEMENTS

We thank Dr Ananda Nisalak from the Armed Forces Research Institute of Medical Sciences for the virologic study.

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