

Utility of Tourniquet Test for Early Differentiation of Suspected Dengue Cases in the Dengue Camp during Outbreak, 2011

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ABSTRACT

Background: The increased workload of dengue patients in epidemic period necessitates prompt clinical diagnosis with all possible diagnostic tools to improve morbidity and mortality of patients.

Objectives: To determine possible role of simple clinical test for early diagnosis of suspected dengue infection during epidemic period while the blood cell counts of reporting adult persons are still relatively normal

Material & Methods: Cross-sectional survey was conducted in emergency dengue camp of Shalamar Hospital, Lahore from 1-10-2011 to 30-11-2011. Hematological investigation and Tourniquet test were carried out on reporting cases of suspected Dengue fever. Probable Dengue Fever and Dengue Hemorrhagic Fever were defined on WHO criteria. Comparison between positive and negative groups of Tourniquet test was also done, in terms of clinical features and hematological findings.

Results: Out of 129 suspected dengue infection cases, 111 cases fulfilled the selection criteria, with age range of 12 years to 68 years and comprised of 65.2% males. 92 cases were categorized as Probable Dengue fever patients. Tourniquet test was found positive in 26 out of 92 Probable Dengue fever and 3 out of 19 remaining Suspected patients. Diagnostic accuracy was 37.84% with positive predictive value of 89.65%. Platelets count ($<100,000/\mu\text{L}$) was present in 44.56% patients. However, significantly less count was recorded in Tourniquet test positive group as compared to negative group ($p=0.01$).

White blood cells count ($\leq 5000/\mu\text{L}$) and raised Hematocrit ($>46\%$ for male & $>40\%$ for female) were found in 64.1% and 39.1% patients respectively ($p>0.05$).

Conclusion: Positive Tourniquet Test is helpful in the early diagnosis of Dengue Fever and Dengue Hemorrhagic Fever in outdoor epidemic settings, without waiting for dengue serology for confirmed diagnoses.

Key words: Probable Dengue fever, Tourniquet test, Probable Dengue hemorrhagic fever

INTRODUCTION

Dengue is the viral infection¹ that has put two fifths of the world's population in tropical and subtropical countries at risk, with an estimated 50 million dengue infections and 500,000 people require hospitalization annually.² In Pakistan, Dengue Fever (DF) was first detected during 1994 but has now become endemic in almost all geographical regions of Pakistan.³ In year 2011, out of 5, 80,010 suspected DF patients, 22,273 probable cases were reported from Punjab.^{3,4} Moreover total 17,610 cases (13,999 cases⁵ till 3 October, 2011) and 294 deaths were reported from Lahore city only.⁴ The burden of severe dengue is underestimated when strict Dengue Hemorrhagic Fever (DHF) / Dengue Shock Syndrome (DSS) guidelines are enforced.⁶ Many cases of Dengue

infections are asymptomatic.¹ Clinical diagnosis can be reinforced with positive tourniquet test along with clinical examination findings including petechiae or overt bleeding (in the absence of underlying causes such as pre-existing gastrointestinal lesions) may be helpful in diagnosis of DF and DHF.^{1,7,8} The tourniquet test is considered positive if 10 or more petechiae per square inch are observed.⁸ The sensitivity of the test varies widely from as low as 0% to 57% depending on the phase of illness during which the test was done and how often the test was repeated, if initially negative.⁸ A study in Puerto Rico showed that 52% of laboratory positive dengue cases had positive tourniquet test versus 18% of patients without dengue ($P<0.001$).⁹ In the early febrile phase, platelets and white blood cell

(WBC) counts are usually within normal range but they will decrease rapidly as the disease progresses to the late febrile phase or at defervescence, and platelets may continue to remain low for the first few days of recovery and is typically preceded by recovery of total WBC count.⁸ This leucopenia followed by progressive thrombocytopenia is suggestive of dengue infection and should alert the physician to a high index of suspicion of dengue infection especially when there is positive history of neighborhood dengue.⁸ The Puerto Rico study reported that 87% of laboratory positive dengue cases had leucopenia versus 28% of patients without dengue ($P < 0.001$).⁹ The presence of either a positive tourniquet test or leucopenia correctly identified 94% of dengue patients.⁹ The ratio of neutrophil to lymphocyte is useful to predict the critical period of plasma leakage.⁸ A rising hematocrit level ($>20\%$) is a marker of plasma leakage in dengue infection and helps to differentiate between DF and DHF but can be masked with concurrent significant bleeding and in those receiving early fluid replacement.^{6,8,10-12} In the absence of a baseline hematocrit level, a hematocrit $> 40\%$ in adult female and $>46\%$ in adult male should raise the suspicion of plasma leakage.⁸ A recent study demonstrated that there was 95.3% positive predictive value if fever, positive tourniquet test, leucopenia, thrombocytopenia, hemo-concentration were used as screening criteria.¹⁰

We tried to evaluate simple clinical test for augmenting early diagnosis of dengue infection, as many cases remains asymptomatic and facilitate prompt reporting system in epidemic scenario.

MATERIALS AND METHODS

Study Population: This cross-sectional study was conducted at Shalamar Hospital Lahore during dengue epidemic, 2011 after approval from Institutional Review Board (IRB) of the hospital. Adult patients suspected to suffer from DF or DHF and reporting at Dengue Patients Camp, established in the hospital premises were interviewed and examined from October 01 to November 30, 2011.

Selection Criteria: Adult persons reporting at dengue camp for diagnosis and management as well as adult patients coming on follow-up visits for clinical and laboratory monitoring were included in the study. Patients either coming in critical condition or unable to withstand cuff pressure for 5 minutes during tourniquet test or having history of

hemorrhagic disorders or females (premenstrual & postmenstrual who are not taking hormones) or those with sun damaged skin and children less than 12 years of age were excluded from the study.

Data Collection: During the mid-epidemic period, patients visiting the dengue camp were interviewed after seeking their verbal consent, and explaining the purpose of study and procedure of tourniquet test. Data was recorded on pre-designed questionnaire after validating test. Data regarding age, gender, educational level, address and presence of similar patients in family was recorded. On physical examination, temperature, pulse rate and pulse pressure were recorded. One ml venous blood sample was collected from each patient inside the camp and sent for assessing complete blood count (CBC) and hematocrit. All the personnel performing laboratory tests were unaware of the clinical condition of the patients and results of their laboratory tests. Hematocrit was however not followed and single reading on the day of examination was recorded. It was considered raised if more than the cut-off value ($>46\%$ for male and $>40\%$ in females). Tourniquet test was performed on all the patients, both probable and suspected cases. Mercury sphygmomanometer was used while keeping it at the heart level of the comfortably sitting patients. An appropriate sized blood pressure cuff was applied on upper arm and inflated to a reading lying between the systolic and diastolic blood pressures of patients for five minutes. After removing the cuff, the number of petechiae per square-inch skin area under pressure was counted using transparent fine polythene patch.

Data Analysis: SPSS 17.0 was used for analysis. Diagnostic accuracy, sensitivity, specificity, PPV and NPV of tourniquet test and comparison test positive and negative groups among probable cases of DF was given. Difference in both groups was analyzed statistically by applying Chi-square and student t-test of significance, and p -value was calculated (value of <0.05 was considered significant).

RESULTS

A total of 129 suspected dengue infection patients were registered in this study during dengue epidemic, year 2011. Among them, 7 patients had age less than 12 years, 9 did not withstand cuff pressure and 2 patients were seriously ill and hence these 18 patients were excluded from the

study. The remaining 111 cases of the study fell in the adult age group ranging from 12 years to 68 years with mean \pm sd of 32.95 ± 14.1 years (figure I) and tourniquet test was performed on all these patients. Out of these patients, 82.8% (n=92) patients presented with clinical features of Probable DF patients according to WHO criteria. They comprised of 65.2% males (n=60) and 34.8% females (n=32). 55.43% patients (n= 51) had education up to matriculation level while 25% had no formal education. Tourniquet test was found positive in 28.26% patients (n=26). Tourniquet test

was also conducted in those 19 Suspected Dengue patients, who did not fulfill the case definition of Probable DF but had reported at Dengue camp with non-specific complaints. The test was positive in 3 patients out of them (table I). Sensitivity, Specificity, Positive predictive value (PPV) and Negative predictive value (NPV) of tourniquet test was 28.26%, 84.21%, 89.65% and 19.5% respectively with Diagnostic Accuracy of 37.84% (Table II).

Figure I: Age distribution of 'Probable DF' patients (n=92)

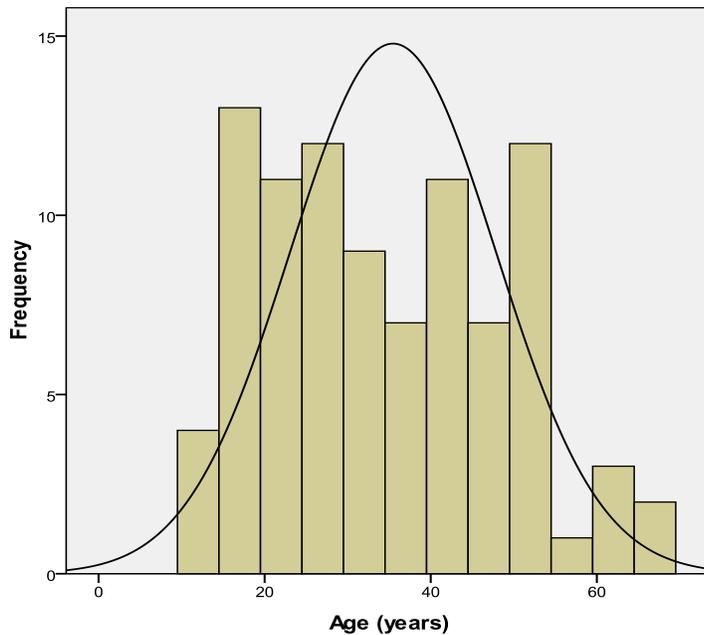


Table I: Accuracy of Tourniquet Test in Suspected Dengue patients (n=111)

		Probable DF Patients	
		Yes	No
Tourniquet Test	Positive	26	3
	Negative	66	16

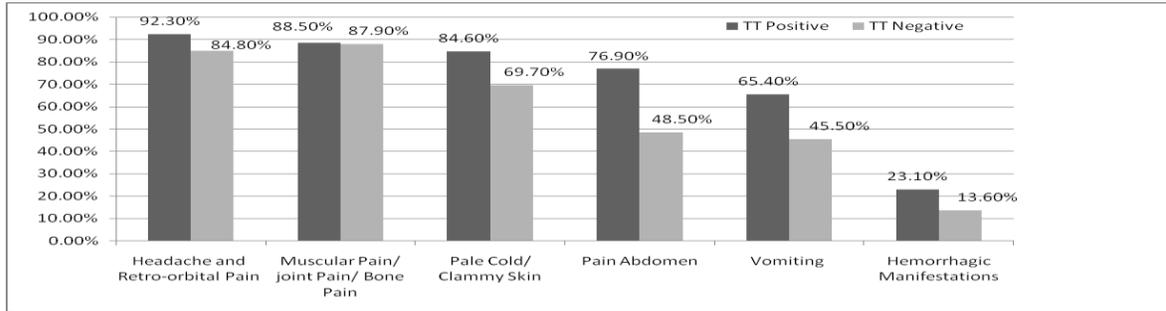
Diagnostic accuracy of TT was 37.84% with Lower, Upper 95% CI of 29.37, 47.12 (Table II).

Table II: Evaluation of Tourniquet Test in Suspected Dengue patients (n=111)

		Lower, Upper 95% CI
Diagnostic Accuracy	37.84%	29.37, 47.12
Sensitivity	28.26%	20.08, 38.19
Specificity	84.21%	62.43, 94.48
PPV	89.65%	73.61, 96.42

NPV	19.51%	12.38, 29.37
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Figure II: Distribution of Clinical Features among Probable DF Patients (n=92)



Note: Patients could have one or more clinical features simultaneously in each group.

Table III: Distribution of Laboratory Findings among Probable DF Patients (n=92)

Laboratory Findings		Tourniquet Test Positive (n=26)	Tourniquet Test Negative (n=66)	p value
Platelets/ μ L	mean \pm sd	89.96 \pm 76.71	134.6 \pm 77	0.945
	<50,000	42.3%	12.12%	0.01
	>50,000 to 100,000	23.07 %	24.24%	
	>101,000 to 150,000	15.38 %	28.78%	
Total WBC / μ L	mean \pm sd	4.98 \pm 2.85	5.53 \pm 5	0.629
	\leq 5000	61.5%	65.15%	0.745
Hct %	> 46 (male) & >40 (female)	38.46 %	39.39%	0.934

All Probable DF patients had either fever or history of fever, 88% (n= 81) had complaints of muscular/joint /bone pains, 87% complained headache or retro-orbital pain (n=80) while hemorrhagic manifestations (gum bleeding /hematemesis /epistaxis /black stools) were present in 17.3% patients (n=16). The comparison of these clinical features along with some non-specific features like pale cold / clammy skin, abdominal pain and vomiting was made between tourniquet test positive and negative groups (Figure II). The other hemorrhagic skin signs (rash/ petechiae/ ecchymosis /purpura) were not recorded. Thrombocytopenia (platelets <100,000/ μ L) was present in 44.56% (n=41) and severe thrombocytopenia (platelets <50,000/ μ L) was present in 20.65% (n=19) Probable DF patients. On comparison between tourniquet test positive and negative groups, the proportionately less count was recorded in tourniquet test positive

group, and the difference was statistically significant ($p = 0.01$). Total WBC count (\leq 5000 / μ L) and raised hematocrit (> 46% in male & >40 % in female) were found in 64.1% (n=59) and 39.1% (n=36) of Probable DF patients respectively (Table III). Seven patients were categorized as Probable DHF, out of 92 probable DF patients according to WHO criteria.

DISCUSSION

The analysis shows that all age groups were affected by dengue infection, although a slightly increased frequency was found in the age group 15–30 years. Almost similar pattern was reported by other studies.¹³⁻¹⁵ 65.2% patients in our study were males and 34.8% were females. Similar gender distribution was reported by Humayun MA *et al*¹³; 63.6% being males.

The provisional Diagnosis was made by clinical assessment of patients according to WHO criteria,

tourniquet test and hematological findings. The analysis revealed that probable DF cases were 82.8%, while Ahmed S *et al*¹⁶ in 2008 had reported dengue-probable cases up to 63%. Among people, higher percentage of Probable DF cases was due to the increased awareness created during epidemic, leading to convergence of patients towards dengue camp.

However positive tourniquet test was found in 26.12% patients similar to other studies; Gregory CJ *et al*⁹ reported positive test in 22% and Mayxay M *et al*¹⁴ reported positive test in 29.1% patients. Using Tourniquet test as the diagnostic test, its Sensitivity, Specificity, PPV and NPV were also comparable to other studies. Mayxay M *et al*¹⁴ reported Sensitivity of 33.4-34%, Specificity of 84-91%, PPV of 85-90% and NPV of 32.5-34%.

The analysis also revealed that among all the Probable DF patients, 88% had complaints of muscular/joint /bone pains. The proportion is higher than other studies; Mahboob A *et al*¹⁵ reported myalgia in 68.75% & arthralgia in 45.83% patients, while Ahmed S *et al*¹⁶ reported myalgia in 67% patients. Similarly 87% of patients complained about headache or retro-orbital pain higher than 54.17% reported by Mahboob A *et al*¹⁵ & Ahmed S *et al*¹⁶. Hemorrhagic manifestations were present in 17.3% patients higher than 4.17-10.4% as reported by Mahboob A *et al*¹⁵ in and 2% by Ahmed S *et al*¹⁶.

Hematological investigations revealed that presence of significant thrombocytopenia ($P < 0.01$) recorded in this study was similar to other studies. Iqbal R *et al*¹⁷ reported thrombocytopenia in 88.16% of DF patients. Presence of thrombocytopenia was also observed in systemic literature review by Potts JA *et al*¹⁸ (among 9 out of 11 studies) and Bandyopadhyay S *et al*¹⁹ (among 37 papers). While total WBC count (≤ 5000 / μ L) in 64.1% and raised Hematocrit level in 39.1% of this study were lesser than of those reported by Gregory CJ *et al*⁹ (87%) and Butt N *et al*¹¹ (50%) of DF patients respectively.

Higher proportion of clinical features and lesser proportion of hematological findings recorded in the study were possibly due to convergence of patients towards dengue camp in the outbreak scenario. Other studies quoted figures against the confirmed cases but we did not undertake confirmatory tests as the practice was considered not essential during the epidemic, either due to cost or their non-availability.

CONCLUSION

The results of this study have highlighted the importance of positive tourniquet test besides medical history, clinical examination, thrombocytopenia, leucopenia and raised hematocrit for the early diagnosis of DHF in epidemic situation without waiting for dengue serology to confirm the diagnosis. The use of tourniquet test during dengue outbreak is useful tool to identify potentially high risk DHF patients for decreasing their morbidity and mortality.

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