"Assessing the Diagnostic Accuracy of the Tourniquet Test for Dengue Fever

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ABSTRACT

OBJECTIVE: This study aimed to assess the diagnostic accuracy of the Tourniquet test in comparison to dengue IgG/IgM tests among patients with dengue fever.

STUDY DESIGN: A cross-sectional validation study was conducted.

PLACE AND DURATION OF STUDY: The study was carried out at Northwest General Hospital and Research Center from January 2017 to December 2018.

MATERIALS AND METHODS: A total of 150 confirmed cases of dengue fever were included using non-probability convenience sampling. Patients with chronic liver disease, chronic renal failure, or those on anticoagulant/antiplatelet therapy were excluded. The diagnostic accuracy of the Tourniquet test was evaluated within the first 24 hours of admission. Comparison was made between dengue antibodies and the Tourniquet test.

RESULTS: Comparison of diagnostic accuracy between the Tourniquet test and dengue IgM/IgG, considered as the gold standard, revealed 16% true positives, 8.6% false positives, 38% true negatives, and 37.3% false negatives. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were calculated as 30%, 81.42%, 64.86%, 50.44%, and 59.6%, respectively. There was no statistically significant difference between the dengue IgM/IgG gold standard and the Tourniquet test for diagnosing dengue fever (p-value = 0.1, 95% CI 0.9682-1.769).

CONCLUSION: This study suggests that the Tourniquet test exhibits lower sensitivity but higher specificity and moderate diagnostic accuracy, indicating its potential utility in diagnosing acute dengue fever, particularly in resource-limited endemic areas.

KEYWORDS: Dengue fever, Diagnosis, Tourniquet test.

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Introduction:

Acute dengue fever (ADF) is a viral infection which is prevalent globally and significantly emerging in the tropical and subtropical countries, considered endemic by the WHO (1). A total 36,173 cases were reported in Pakistan from 2012-2016 (2)

Almost 390 million people suffer from dengue fever every year, a quarter of which are symptomatic (1). DF has become a public health concern in the last five decades due to its widespread expansion amounting to 30 fold rise in incidence (3). The dengue virus is included in the genus flavivirus in the Flaviviridae family. The mosquito 'Aedesaegypti' is most often the vector for spread of the disease (1). The virus has an incubation period of 3-7 days. This disease has 3 stages, 2-7 days of febrile phase, 1-3 days of critical phase and 3-5 days of recovery phase (4). Myalgia, arthralgia, orbital pain, anorexia, nausea, vomiting, diarrhea and development of rash are the most common clinical features of the disease (5). Mild hemorrhagic manifestations, fever, thrombocytopenia and leucopenia have been reported in the febrile phase of the illness (5). Severe dengue infection has the features of hemorrhagic events called Dengue Hemorrhagic Fever (DHF) and hypovolemic shock (dengue shock syndrome) (4). The common modalities for diagnosis of dengue is performed through the detection of specific IGM and IgG in serological ELISA tests. These diagnostic tests are quite expensive and cannot afforded by the lower socioeconomic class of the rural areas of our county. According to the WHO (1997) recommendations for dengue, Tourniquet test may be utilized to diagnose DHF and DSS but, not DF (1). According to the 2001 WHO guidelines the TT can be to help in diagnosis of DF (6). The objective of this study is to accurately measure the specificity and sensitivity of tourniquet test in patients of dengue fever.

Materials and Methods

A study was conducted at Northwest General Hospital and Research Center, Hayatabad, Peshawar to validate the utility of tourniquet test in 150 patients (age > 14 years) of dengue fever in 2017 who fulfilled the WHO criterion for dengue fever (DF) were included, which is fever and two or more of the following: myalgia, headache, orbital pain, arthralgia, leukopenia, rash and bleeding and who had a confirmed infection on laboratory test. DF patients were distinguished from DHF by the WHO criterion which is 1) fever for more than 2 days, (2) Hemorrhagic manifestation, (3) Platelet Count < 100,000 platelets/ µL, (4) Plasma Leakage (5) were enrolled in the study through non probability convenience sampling. We did not witness any patients of dengue shock syndrome. Patients with other infections which overlap dengue symptoms, diagnosed patients of chronic liver disease, chronic renal failure and those on anticoagulant/antiplatelet therapy were excluded from the study. Tourniquet test was performed through a standardized method by inflating a blood pressure cuff mid-way in between the systolic and diastolic pressures for five minutes. The observation of 10 or more Petechiae per 2.5 cm2 was considered positive. The data were analyzed through SPSS 20. A comparison was carried out between dengue IgM/IgG and TT through a 2x2 table to calculate the diagnostic measures.

Results

In 2017, 150 patients presented to our OPD who fulfilled the WHO criterion for Dengue Fever. The median age was 31, lowest age of

Table 1: Demographics and presentation of patients

Variable	Frequency	Percent (%)
Gender (M/F)	81/69	54/46
Myalgia (Yes/No)	136/14	90.7/9.3
Anorexia (Yes/No)	69/81	46/54
Vomiting (Yes/No)	59/91	39.3/60.7
Diarrhea (Yes/No)	30/120	20/80
Rash (Yes/No)	14/136	9.3/90.7
Bleed (Yes/No)	34/116	22.7/77.3
HCT (High/Normal)	13/137	8.7/91.3

Table 2: Tourniquet Test results vs dengue antibodies IgG/IgM

Tourniquet Test	Dengue serology IgG/IgM		Total
	Positive	Negative	
Positive	True Positive (a) 24 (16%)	False Positive (b) 13 (8.6%)	a + b 37 (24.6%)
Negative	False Negative (c) 56 (37.3%)	True Negative (d) 57 (38%)	c + d 113 (75.3%)
Total	a + c 80 (53.3%)	b+ d 70 (46.6%)	150 (100%)
Sensitivity	30%		
Specificity	81.42%		
Positive Predictive value	64.86%		
Negative Predictive value	50.44%		
Accuracy rate	59.6%		

Table 3. Test for association

	Dengue serology IgG/IgM			x^2 Value	P-value	95% CI
Data analyzed	Positive	Negative	Total	2.62	0.1	0.9682-1.769
Tourniquet Test Positive	24	13	37			
Tourniquet Test Negative	56	57	113			
Total	80	70	150			

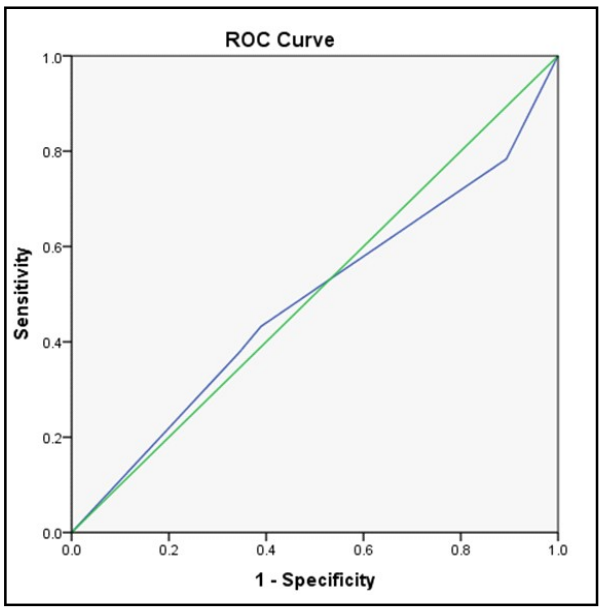


Figure 1.0: ROC Curve; Area under curve is 0.485 (95% CI = 0.37-0.59)

presentation is 14 and highest age is 70. Gender analysis showed 81 patients (54%) were male and 69 patients (46%) were female. Table 1 summarizes the demographics and the presentation of patients who were enrolled in the study.

Dengue antibodies testing showed that 7 patients (4.7%), 53 patients (35.3%), 20 patients (13.3%) patients were reactive for IgG, IgM and both respectively, while 70(46.7%) patients were found to be non-reactive.

The gold standard IgG/IgM shows that 16% were true positive, 38% were true negative, 8.6% were false positive while 37.3% were false negative. Similarly, specificity, positive predictive value, negative predictive value and diagnostic accuracy was calculated as 30%, 81.42%, 64.86%, 50.44%, and 59.6% respectively (table 2).

Figure 1 shows the Receiver operating characteristics (ROC) curve was constructed which highlighted that Area under curve is 0.485 (95% CI = 0.37-0.59). The chi-square test was determined to find any difference between the gold standard IgG/IgM vs. Tourniquet test. Table 3 reveals that there is no statistically significant difference between Gold standard Dengue serology and Tourniquet test with p-value 0.1 (95% CI: 0.9682 - 1.769). The results are graphically shown in figure 2.

Discussion

Multiple studies have been conducted so far in this aspect indicating variability in results, but due the massive increase in the incidence

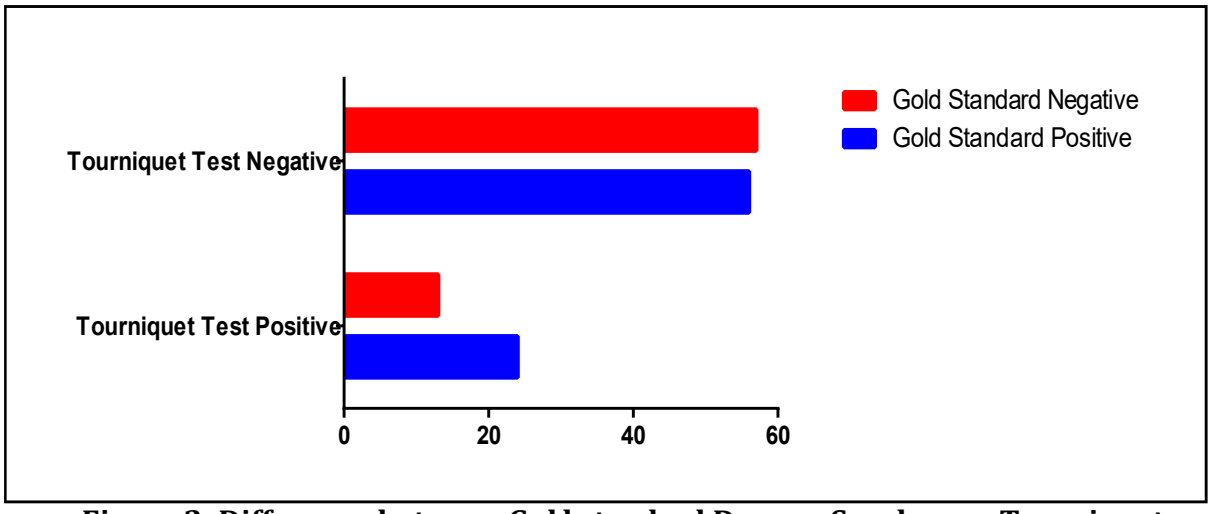


Figure 2: Difference between Gold standard Dengue Serology vs Tourniquet

of dengue fever around the globe signifies the fact that many areas which has suffered from dengue epidemics comprises of people belonging to lower socioeconomic class and are unable the bear the burden of the diagnostic modalities. As indicated by the WHO recommendation 2011 for diagnosis of Dengue fever, tournequet's test is the most affordable modality for diagnosis of dengue fever. A meta analysis which comprised of 28,739 showing pooled sensitivity for dengue diagnosis by TT was 58% (95% Confidence Interval (CI), 43%-71%) and the specificity was 71% (95% CI, 60%-80%). This study concluded that in in poor resource setting area, TT demonstrates a marginal benefit in the diagnosis of dengue fever. Comparable to our results which shows a lesser sensitivity can be contributed to a lower number of cases being compiled. However the meta analysis concludes that TT is still of greater clinical importance in endemic areas (7).

A study conducted in Brazilian city which analyzed 28,000 trails with 119,589 suspected dengue cases showed 30,670 positive for dengue fever with a low sensitivity, low positive predictive value, high specificity and a high negative predictive value for diagnosis of dengue fever via TT. This shows that it has been agreed upon that the negative predictive and specificity as found by our study is higher for TT in diagnosing dengue fever. TT is mor effective in detecting cases which are true negativennot be negated that in rural areas where the pateints can not afford the cost of Dengue IgG/IgM, tourniquet test should be employed as an aid tool in the clinical diagnosis of the acute dengue fever. However, it should be just for screening and not as a tool for confirmation of diagnosis (7, 8).This study emphasizes that the treating physicians should make the clinical use of TT more promptly in diagnosing suspected cases of dengue fever. Our study findings are in agreement with most of the studies carried out in this aspect (4, 9, 10).

Conclusion

Since this study showed a high specificity and negative predictive vaule, hence TT should be used as a bedside test in detecting true negatives in suspected cases of dengue fever and especially in areas where the patient cannot afford Dengue IgG/IgM.

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Authors Contribution:
Dr. Saad Abdul Razzaq contributed to the conception and design of the study acquisition of data, Dr Mariam Imran help in drafting the manuscript and interpretation of data.., Dr. Zahid Mehmood, Dr. Zawwar Reza, Dr. Ghansham, Dr Hazrat Bilal Burki contributed to the acquisition, analysis and interpretation of data along. All authors approved the final version of the manuscript.

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