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Rapid point-of-care diagnosis of chikungunya virus infection

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Diagnosis of Chikungunya Infection at Sant Parmanand Hospital, Delhi, India

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ABSTRACT

Objective: To detect a rapid disease diagnosis for clinical management and preventive measures of chikungunya virus infection. **Methods:** The utility of a point-of-care test that could be used in field and health care centers was investigated employing a commercially available diagnostic kit at a tertiary care, multidisciplinary hospital in the Indian capital metropolis during 2010. **Results:** During the 2010 spurt of chikungunya cases in Delhi, India, the performance of the OnSite chikungunya IgM Combo Rapid Test kit (CTK Biotech, San Diego, USA) well matched with the chikungunya IgM capture ELISA kits (National Institute of Virology, Pune, India). The sensitivity and specificity of the rapid test in relation to the IgM capture ELISA were 0.71 (95% *CI*: 0.30 to 0.94) and 1.00 (95% *CI*: 0.46 to 2.10), respectively. The respective positive and negative predictive values were 1.0 (95% *CI*: 0.46 to 1.00) and 0.7 (95% *CI*: 0.30 to 0.94). **Conclusions:** Commercial assay kits to detect chikungunya IgM antibody are essential in health care centers which lack facilities for cell culture or enzyme immunoassay. Hence, it should be possible for health centers even in poorer countries to use the OnSite Chikungunya IgM Combo Rapid Test kit as a matter of routine to early diagnosis and to initiate control measures for chikungunya.

1. Introduction

The chikungunya virus (CHIK) is a mosquito-borne virus transmitted by *Aedes aegypti* or *Aedes albopictus*. There has been a wide global dissemination during the past five years[1,2]. Conventionally, a specific CHIK diagnosis is made through detection of virus in samples collected in the early phase of illness by reverse transcriptase-polymerase chain reaction (RT-PCR) or virus isolations in C6/36 or vero cell lines. Later, anti-CHIK antibodies are present in patients that are detected by an enzyme immunoassay or immunofluorescence assay.

The diagnostic utility of one of the commercial rapid CHIK IgM assay was investigated during the 2010 spurt in CHIK- and dengue- virus cases in the Indian capital metropolis of New Delhi. Preliminary data have been affirmative and the assay is preferred by clinicians for better management of their patients.

2. Materials and methods

Point-of-care hunt for CHIK IgM-positive patients was carried out employing the OnSite Chikungunya IgM Combo Rapid Test kit (CTK Biotech, San Diego, USA). During November 2010, several CHIK cases were encountered at the Sant Parmanand Hospital, Delhi, a 140-bed, tertiary care, multi-disciplinary hospital which caters to the population in the national capital and adjoining townships. The point-of-care CHIK IgM search was carried out in 100 cases employing the OnSite Chikungunya IgM Combo Rapid Test kit (CTK Biotech, San Diego, USA) in the hospital laboratory premises itself. The lateral flow immunoassay results were available within 20 minutes. The samples from the initial ten cases were tested in parallel at the National Centre for Disease Control, Delhi, using the chikungunya IgM capture ELISA kits (National Institute of Virology, Pune, India).

3. Results

Among the 100 patients, 14 were positive for CHIK IgM

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while 86 were negative. Among the IgM positives, five were positive both by the rapid test and ELISA and nine were positive only by IgM capture ELISA. The disease diagnosis was promptly confirmed in 12 cases with the IgM rapid test kit (CTK Biotech, Inc) even though it had failed to identify two patients, who were positive only during IgM capture ELISA. There was no false-positive labeling with the rapid test kit.

The sensitivity and specificity of the rapid test in relation to the IgM capture ELISA were 0.71 (95% *CI*: 0.30 to 0.94) and 1.00 (95% *CI*: 0.46 to 2.10), respectively. The respective positive and negative predictive values were 1.0 (95% *CI*: 0.46 to 1.00) and 0.7 (95% *CI*: 0.30 to 0.94).

4. Discussion

The sensitivity of any rapid or IgM capture ELISA or RT-PCR can be low during the initial phase of illness as the level of viremia and/or IgM antibody would be feeble earlier on and could well escape detection. In Thailand, the rapid test sensitivity and specificity during the first week were 22% and 88%, respectively. However, after one week, the sensitivity increased to 83% and specificity decreased to 71%[3].

The point-of-care CHIK diagnosis can promote prompt clinical and preventive response. This would avoid indiscriminate medication including antibiotic prescriptions resulting in mortality[4,5]. Consequently, disease notification and anti-vector measures would be taken promptly to contain the secondary viral propagation as the extrinsic incubation period in mosquitoes is just 2-3 days and in humans is just 4-5 days[6].

Ideally, a RT-PCR should be performed in all clinically suspected IgM negative cases in order to have the highest possible certainty about virologic diagnosis. Such facilities are not available in our hospital. Consequently, our CHIK isolates could not be characterized by the phylogenic analysis and neutralization assays.

The lateral flow immunoassay results would be on hand within 20 minutes. Presently the test is available on a reasonable cost. But it can be brought down further if it is produced in larger quantities. Hence, it should be possible for health centers even in poorer countries to use this test as a matter of routine to early diagnosis and to initiate control measures for chikungunya. Laboratory facilities are poor not only in remote locations but also in many big cities.

In conclusion, a rapid, simple and reliable diagnostic test for CHIK would be indispensable to assist health care centers which lack well-equipped laboratories with results being in 20 minutes. Hence, it should be possible for health centers even in poorer countries to use this test as a matter of routine to early diagnosis and to initiate control measures for chikungunya[7]. Moreover, a point-of-care diagnostic like the OnSite Chikungunya IgM Combo Rapid Test Kit (CTK Biotech, San Diego, CA) would also be valuable in secondary or tertiary care health centers.

After a gap of five years, there has been a re-emergence of local transmission of chikungunya virus since March 2010 in the Réunion Island, French territory[8]. Point-of-care diagnostic will be useful at health care centers to manage any disease re-emergence at the Réunion Island or other places[8].

Conflict of interest statement

We declare that we have no conflict of interest.

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