

IVD.13 - A fully automated lab-on-a-chip platform for arboviral diagnosis

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Introduction: The rapid and continuous emergence of epidemic arboviral diseases (i.e. Zika, Dengue, Chikungunya, and Yellow Fever) presents a serious challenge to public health. The multiple *Aedes*-transmitted diseases with similar clinically indistinguishable febrile syndromes, underscores the need for sensitive and specific diagnostic tests that can differentiate between them.

Objective: Here we present the development of a multiplex RT-qPCR lab-on-a-chip-based point-of-care-platform (POC) for differential diagnosis of Zika, Dengue 1, 2, 3 and 4 and Chikungunya viruses.

Methodology: The overall system consists of a single-use disposable microfluidic chip and an instrument to operate and read out the tests. The overall protocol consists of a fully integrated and automated cartridge, containing all reagents required to carry out the assay, which consists of whole blood sample uptake, lysis, RNA extraction and purification, cDNA synthesis and qPCR amplification.

Results: First, the conventional one-step RT-qPCR protocol previously developed at IBMP to detect and differentiate the viruses above mentioned was implemented on-chip using a modular approach for each step of the protocol. The optimized and validated processes and conditions compatible with the performance observed on regular laboratory instruments were used to design the integrated cartridge prototype and the respective instrument to control the complete processing on-chip. The fluidic protocol was initially validated with liquid colored solutions, and after that with buffers and lyophilized reagents. Whole blood artificially contaminated with virus-like particles was used to validate the analytical process. Reagents stability study and performance of the system with clinical samples are under evaluation to validate the platform.

Conclusion: The chip can perform simultaneously a wide range of tests based on RT-qPCR distributed on its 16 reaction chambers.

Keywords: lab-on-a-chip; arbovirus; diagnosis