Integrated Lateral Flow Electrochemical Strip for Leptospirosis Diagnosis

Authors : Wanwisa Deenin, Abdulhadee Yakoh, Chahya Kreangkaiwal, Orawon Chailapakul, Kanitha Patarakul, Sudkate Chaiyo

Abstract : LipL32 is an outer membrane protein present only on pathogenic Leptospira species, which are the causative agent of leptospirosis. Leptospirosis symptoms are often misdiagnosed with other febrile illnesses as the clinical manifestations are non-specific. Therefore, an accurate diagnostic tool for leptospirosis is indeed critical for proper and prompt treatment. Typical diagnosis via serological assays is generally performed to assess the antibodies produced against Leptospira. However, their delayed antibody response and complicated procedure are undoubtedly limited the practical utilization especially in primary care setting. Here, we demonstrate for the first time an early-stage detection of LipL32 by an integrated lateral-flow immunoassay with electrochemical readout (eLFIA). A ferrocene trace tag was monitored via differential pulse voltammetry operated on a smartphone-based device, thus allowing for on-field testing. Superior performance in terms of the lowest detectable limit of detection (LOD) of 8.53 pg/mL and broad linear dynamic range (5 orders of magnitude) among other sensors available thus far was established. Additionally, the developed test strip provided a straightforward yet sensitive approach for diagnosis of leptospirosis using the collected human sera from patients, in which the results were comparable to the real-time polymerase chain reaction technique.

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