REVOLUTIONARY DIAGNOSTICS – NONTRADITIONAL APPROACHES FOR DEVELOPING BREAKTHROUGH CAPABILITIES AGAINST EMERGING THREATS

Development Of A Diagnostic Toolbox For Detection And Surveillance Of Crimean-congo Hemorrhagic Fever Virus

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The spread of infectious disease continues to present a challenge for modern global public health initiatives, as was evidenced by the Ebola outbreak in West Africa and the current SARS-CoV-2 pandemic. Access to sustainable diagnostic tools for disease detection and surveillance is critical to staying ahead of potential outbreaks in non-human and human populations. Crimean-Congo Hemorrhagic Fever virus (CCHFV) is a tick-borne pathogen belonging to the Nairoviridae family within the Bunyavirales order. CCHF is the most widespread tick-borne human disease due to the geographical distribution of its vector, the Hyalomma tick. Due to vector prevalence, high fatality rate, and the lack of medical countermeasures for treatment/prevention of disease, CCHFV is characterized as a high priority pathogen by the World Health Organization. There is a growing concern of CCHFV being introduced to previously naïve areas as tick distribution extends through a combination of climate change, anthropogenic factors, and transportation on infested birds, imported livestock, or both. We have developed a suite of immunoassays for the detection of CCHFV antigen and antibody prevalence using magnetic bead-based platforms, lateral flow immunoassays, and microfluidic platforms. Each of these assay designs utilizes sustainable reagents such as recombinant proteins and monoclonal antibodies to achieve a diagnostic result. We were able to detect CCHFV nucleoprotein on three immunoassay platforms using the same set of reagents, thus highlighting the ability to tailor the diagnostic assay for the use-case scenario (e.g., point of care/field testing to reference lab testing). We developed four serologic assays to detect anti-CCHFV nucleoprotein response in a sample for use in non-human samples such as cattle and sheep as well as human samples. We applied some of these methods to screen livestock herders from rural Ghana and found 13% (39/300) positivity rate for CCHFV antibody prevalence. By developing sustainable diagnostic tools and transitioning these capabilities to our in-country collaborators, we have the best chance at rapidly responding to emerging infectious diseases, protecting the warfighter, and ultimately avoiding another widespread outbreak.