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Abstract

Novel Methodology for the Detection of Enveloped Viruses †

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Abstract: Viral infections in humans cause a huge burden in worldwide healthcare that has increased due to the emergence of new pathogenic viruses, such as in the recent Ebola virus (EBOV) outbreaks. Viral particles in body fluids are often at very low levels, making diagnosis difficult. In order to address this problem, we have developed a new detection platform to isolate and detect different enveloped viruses. We have recently identified that sialic acid-binding Ig-like lectin 1 (Siglec-1/CD169) is one cellular receptor used by EBOV and HIV-1 to enter myeloid cells, key target cells for infection and pathogenesis. For viral uptake, the V-set domain of this myeloid cell receptor recognizes the gangliosides of viral membranes that were dragged during viral budding from the plasma membrane of infected cells. We took advantage of this specific interaction between Siglec-1 and viral gangliosides to develop a new detection methodology. We have generated a recombinant protein that contains the V-set domain of Siglec-1 fused to the human IgG Fc domain for anchoring in latex beads. These coated beads allow the isolation of viral particles and their measurement by flow cytometry. We have tested its efficacy to detect HIV-1 and EBOV and its specificity by using anti-Siglec-1 antibodies that prevent the interaction and serve as a negative control. To test the capacity of our method, we used synthetic liposomes to assess the effect of ganglioside concentration in membranes as well as the size of viral particles. This methodology would facilitate the diagnosis of infections by concentrating viral particles in a fast and direct method. At a time when global human mobility facilitates the dissemination of infectious agents, our approach represents a rapid and effective method to maximize the identification of both known and emerging enveloped viruses as part of public health viral surveillance strategies.

Keywords: Siglec-1; HIV-1; Ebola virus; enveloped particles; Isolation methods