Characterization of a rapid HIV-1 incidence assay based on a CDC-developed multisubtype antigen in a commercial HIV lateral flow assay format

WEPE105

Sedia Rapid Incidence

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Materials and Methods

A simple, lateral flow Rapid HIV-1 Incidence Assay (RHIA) similar to one developed by the CDC was designed based on Sedia’s commercial AssaTech™ rapid diagnostic format. The Sedia test gives results within 20 to 45 minutes after placing the assay strip into sample comprised of blood, serum or plasma diluted 1:200 in a diluent. Results were read blindly by the reader at both 20 and 45 minutes. Our assay incorporates a recombiant multi-subtype antigen developed by the CDC for the HIV-1 LAg-Avidity as an incidence line. The assay has three reaction lines as shown in the photo above: 1) a control line, 2) a test or preva- lence line (reactive with all HIV-1 positive specimens) and 3) an incidence line (reactive only with long-term infections). The assay was evaluated against 419 well characterized HIV-1 positive sera obtained from multiple sources including the U.S. CDC (both DGHIA and NHAP), CEPHIA, commercial HIV panels, rejected plasma donors, and other commercial sources. Additional specimens were tested beyond those reported in the originally submitted abstract. Samples were characterized by the HIV-1 LAg-Avidity the BEDI HIV-1 Incidence EIAs and western blot according to the manufacturers’ instructions.

Results

The results below are based on the performance of the RHIA relative to the HIV-1 LAg-Avidity EIA and the BEDI HIV-1 Incidence EIA. Occasionally, there were slight differences in the RHIA between 20 and 45 minute reads, typically due to assay strip clearing and subjective but subtle changes in the incidence line. This is a limitation inherent in rapid test technology well known to manufacturers and frequent users of such rapid assays, where experienced readers may see changes or detect lines that novice readers miss. The RHIA was tested to match the mean duration of recent infection (MDRI) of the LAg-Avidity EIA (130 days). However lower False Recent Rate (FRR) results were observed relative to the BEDI EIA primarily due to BEDI EIA’s longer MDRI (157 days). The MDRI of the RHIA has not yet been determined using a typical population. Differences in MDRI can affect the reported FRR in direct correlations to other lab assays as used here.

Introduction

Estimates of HIV incidence are critical to monitoring the spread of the HIV epidemic, identifying “hot spots” of new infections, and managing and assessing intervention efforts. HIV incidence is optimally determined by large longitudinal cohort studies. However, such studies are time-consuming and expensive, and have their own built in biases. Over the past few years, efforts have been focused on laboratory approaches detecting new HIV infections to estimate HIV incidence. These include commercial assays specifically designed to identify new infections, such as the Sedia™ HIV-1 Limiting Antigen EIA and the Sedia™ BEDI HIV-1 Incidence EIA. Such assays are more cost effective than longitudinal cohort studies for incidence estimates, but are not easily characterized in resource-limited settings outside of laboratories. This study presents a simple, point-of-care Rapid HIV-1 Incidence Assay (RHIA), similar in principle to rapid blood diagnostic assays, suitable for field use that can be performed with minimal training and can significantly expand access to HIV incidence measurements.

Conclusions

This study is not intended as a definitive analysis of the performance of the Rapid HIV-1 Incidence Assay. It does, however, demonstrate feasibility of using a commercial rapid assay format for differentiating recent from long-term infections. The performance of the RHIA is likely not yet optimal and may be influenced by several factors:

- **Absence of Gold Standard Laboratory Assay.** Neither assay used as the comparator in this study is considered the gold standard by which incidence assays are measured. Although the more recently developed LAg-Avidity EIA improves the accuracy of HIV incidence estimates over the BEDI EIA, specimens identified as “recent” or “long-term” by either assay may be mischaracterized. There is no “gold standard” laboratory assay for measuring HIV incidence. The best gold standard is a collection of specimens from longitudinal cohort studies of known duration of infection, however such specimens are not widely available.

- **Effect of Window Period on False Recent Rate.** Although the RHIA was designed so that its “window period” (MDRI) was similar to the HIV-1 LAg-Avidity EIA, there is likely to be some difference, which can affect the FRR. This effect is demonstrated by the greater disparity between the RHIA and the BEDI EIA, since the latter likely has a longer MDRI than the rapid test. The next step in characterizing the rapid HIV Incidence Assay is to assess its MDRI and determine its FRR in a representative population with HIV-infected individuals of known duration of infection.

**Literature Cited**


**Acknowledgments**

We thank Shefa Patel and Yen-Dzung of CDC (CDC/CHGS/DHGIA) and Michelle Owen and Tim Granade of the CDC (CDC/CHGS/FOHPHA) for providing specimens and technical discussions. We also thank the Consortium for the Evaluation and Performance of HIV Incidence Assays (CEPHIA) for providing an incidence test panel. The HIV-1 antigen used in the incidence line is provided by the CDC to Sedia under a Proprietary Technology License Agreement.