

Nanoparticle-Based Biobarcode Amplification Assay (BCA) for Sensitive and Early Detection of Human Immunodeficiency Type 1 Capsid (p24) Antigen

<i>Abstract Category:</i>	New HIV Diagnostic Technologies Including Those That Are Not FDA Approved
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OBJECTIVE

Over the past decade, certain nanotechnology-based techniques have been widely evaluated in medical testing and could provide new tools for clinical diagnosis due to their potential for high degrees of sensitivity, high specificity, multiplexing capabilities and ability to operate without enzymes. We described here a gold nanoparticle-based biobarcode amplification (BCA) assay for early and sensitive detection of HIV-1 capsid (p24) antigen.

METHODS

The BCA assay used anti-p24 antibody-coated microplates to capture p24 antigen and streptavidin coated gold nanoparticles and biotinylated biobarcode DNAs for signal amplification followed by detection of biobarcode by a chip-based scanometric method. For detection, the released biobarcode DNAs were first hybridized with capture oligo coated on the slides and then oliognucleotide-modified nanoparticle probe. Finally, the slides were stained by silver solution. The enhanced signals were captured and quantified by Verigen ID.

RESULTS

The BCA assay exhibited a linear dose-dependent pattern within the detection range of 0.1~500 pg/ml and was approximately 150-fold more sensitive than the conventional enzyme-linked immunosorbent assay (ELISA). No false positive results were observed in 30 HIV-1 negative samples while all 45 HIV-1 RNA positive samples were HIV-1 p24 antigen positive by the BCA assay. In addition, the BCA assay detected HIV-1 infection 3 days earlier than ELISA in seroconversion samples. The further evaluation of the new assay is on-going.

CONCLUSIONS

Our study indicated that nanoparticle-based techniques can dramatically improve the sensitivity of HIV-1 p24 antigen detection in the absence of enzymatic reactions. The preliminary evaluation of the method based on the small size samples indicates that the HIV-1 p24 antigen BCA may provide a new tool for sensitive and early detection of HIV-1 p24 antigen in settings where HIV-1 RNA testing is currently not routinely performed.

*This work was funded by the Office of Science and Health Coordination, Food and Drug Administration.