Engineered mycobacterium tuberculosis antigen assembly into core-shell nanobeads for diagnosis of tuberculosis

ABSTRACT

Despite recent advances in diagnosis, tuberculosis (TB) remains one of the ten leading causes of death worldwide. Here, we engineered Mycobacterium tuberculosis (Mtb) proteins (ESAT6, CFP10, and MTB7.7) to self-assemble into core-shell nanobeads for enhanced TB diagnosis. Respective purified Mtb antigen-coated polyester beads were characterized and their functionality in TB diagnosis was tested in whole blood cytokine release assays. Sensitivity and specificity were studied in 11 pulmonary TB patients (PTB) and 26 healthy individuals composed of 14 Tuberculin Skin Test negative (TSTn) and 12 TST positive (TSTp). The production of 6 cytokines was determined (IFNγ, IP10, IL2, TNFα, CCL3, and CCL11). To differentiate PTB from healthy individuals (TSTp + TSTn), the best individual cytokines were IL2 and CCL11 (>80% sensitivity and specificity) and the best combination was IP10 + IL2 (>90% sensitivity and specificity). We describe an innovative approach using full-length antigens attached to biopolyester nanobeads enabling sensitive and specific detection of human TB.