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Rapid detection and profiling of rare cancer cells with a portable holographic imaging system HYUNGSOON IM, JUN SONG, MONTY LI-ONG, LIOUBOV FEXON, MISHA PIVOVAROV, Massachusetts General Hospital, RALPH WEISSLEDER, Massachusetts General Hospital, Harvard Medical School, HAKHO LEE, Massachusetts General Hospital — We herein present the detection and molecular profiling of rare cancer cells, using a chip-based holographic imaging system. In this approach, target cancer cells are labeled with molecular-specific microbeads. Such labeling enables 1) a reliable differentiation between cancer cells and host cells (e.g., leukocytes); and 2) quantitative profiling of target marker expression through bead-counting. A new algorithm for digital image reconstruction and bead counting was developed as well to facilitate the assay. The developed system were able to accurately count more than thousands of beads and cells in a single image. Importantly, the assay could be performed without any dilution or washing steps, minimizing cell loss and simplifying the assay procedure. By counting the number of beads attached on cells, we could also measure the expression levels of different cancer markers, which showed good agreement with profiling results by flow cytometry and fluorescence microscopy. This cost-effective, portable, flow-based holographic imaging system is applicable to detecting rare cancer cells in a large volume of blood samples for point-of-care applications.

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